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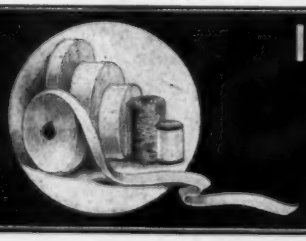

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ENGINEERS IN CONFERENCE.

LAST week was signalised by the resumption of the series of Engineering Conferences organised by the Institution of Civil Engineers, which was interrupted by the war; a very full programme was laid before the members, and there was a great deal that was interesting in the proceedings, which, despite one or two small hitches, proved very successful.

The presence of the American engineers delegated to confer upon Sir Robert Hadfield—and, through him, the British engineering profession in general—the highest honour at the command of the kindred fraternity in the United States, greatly enhanced the dignity and significance of the assembly over which Mr. John A. Brodie presided, and the large attendance of engineers from all parts of the country bore witness to their interest in the proceedings.

We were glad that the President, in opening the Conference, seized the opportunity to impress upon the audience the fact that the engineer owed it to the community to take an active part in the solution of the social and industrial problems with which the nation is confronted to-day. It is an old theme with us; we have always held that the training of an engineer, which involved not only the development of a logical and scientific habit of thought, but also an intimate association from the commencement of his apprenticeship with the manual workers in the industry, peculiarly fitted him to deal with labour questions, while the constant necessity of studying ways and means of attaining desired results with the minimum expenditure of time, effort, and money—in other words, the science of commercial efficiency—similarly equipped him with qualities essential to the successful conduct of public affairs. These are not all the requirements, it is true; the study of economics in the broadest sense, and of politics (but not the politics of the professional politician, from whom deliver us) is also necessary, but the competent engineer is a student to the end of his life, and may be trusted to acquire such information when he needs it. The same note was struck by Dr. Ira N. Hollis in responding to the President's welcome; he emphasised the necessity for the engineer to take his share in the social and political work of the world, and in evolving a new social system based on the doctrines of Christianity.

Turning to the work of the Conference, we may remark that there were over 50 short papers introducing discussions in seven Sections, sitting simultaneously, and that to attempt to survey this mass of matter would call for the qualities of a superman. Add to this the fact that the Institution of Mechanical Engineers was holding its London Summer Meeting at the same time, discussing 16 branches of the subject of "Thermal Efficiency of Heat Power Plants" during two of the three

days, and we have the conditions for a severe attack of mental indigestion. Unlike the proceedings of the Engineering Conference, the whole of the work of the Mechanical Engineers' Conference was of more or less immediate interest to the electrical and allied industries, and we are glad to know that it will be made available in printed form by the Institution concerned.

Whilst we do not question the obvious necessity of holding sectional meetings simultaneously on occasions of this nature, we doubt the wisdom of holding *two* engineering conferences at the same time, and we feel that it indicates a lack of co-ordination or co-operation between the two societies. We know that those words are becoming somewhat wearisome, but there never was a time in our industrial history when the observance of the principles which they denote was more imperatively necessary. We understand that the Summer Meeting was originally fixed for the preceding week; was the date altered merely in order to receive the American delegation, or was it true—as we have heard—that a spirit of rivalry (we would not say jealousy) was the cause? Whatever the reason, we think the decision was somewhat ill-advised and unfortunate. By all means let us have a large joint conference, but let it be one. We look forward to the day when the electrical societies in this country will join hands, under the ægis of E.D.A., in holding a convention comparable to the huge and enthusiastic gatherings of the N.E.L.A. in the United States—united and harmonious.

COMPETITION IN THE SOUTH AMERICAN MARKET.

During the course of the war the South American market was necessarily deprived of most of the customary imports of electrical machinery and plant from Europe, and both Japanese and American firms endeavoured to step into the breach. Swiss engineering works did a certain amount of business, or rather, made efforts to execute old orders when export and transport facilities were available to them. To the credit of at least two Swiss engineering firms can be set on record the fact that they definitely refused offers made to them by German firms to act as the intermediaries for the latter in the oversea export trade, in contradistinction to what happened or what was sought to be accomplished in certain other countries in Europe. As already mentioned, the Japanese succeeded in entering the South American market, while American firms tried greatly to extend the scope of their business in that part of the world. On the other hand, the German agents of all kinds in South America or their nominees made a practice of purchasing electrical and other engineering manufactures from American works for the purpose of keeping alive the German connections during the war. Black lists or no black lists, the intermediaries of the German agents managed to retain the connections for the latter in some form or other, for while it was possible to prevent German trading through intermediaries in European countries, it was impossible entirely to stop such trading by the operation of black lists enforced as far as possible by Allied diplomatic action in South America.

Now the turn of the tide appears to have begun. Japan, which in pre-war times had no labour question in the European sense of the term, has one at present, and it is said that the very cheap Japanese labour is a matter of the past, owing to labour disputes and the higher wages which have to be paid to the men, who have awakened from their former ready resignation to circumstances. The Americans, too, have a labour problem to some extent, but not of the kind which will probably confront them, because they cannot expect to escape a reaction of the European labour movements at some future time. What these facts mean in connection with the South American market is that by way of comparison with the goods which the Germans are pouring into that continent, the Japanese and the American goods, at all events the latter, have become very dear and are unsaleable. Large shipments of German iron and steel, mechanical appliances of various descriptions, and electrical machinery, are understood to have reached South America at prices at which American manufacturers are unable to compete because they were produced at high prime costs, and are now lying unsold at the ports and warehouses in South America. No wonder the Americans are becoming alarmed at the change in the situation of affairs.

There is no doubt that German competition in the South American market has now set in with renewed vigour for many reasons. Apart from the facilities afforded by the depreciated German currency, wages in Germany are really insignificant, notwithstanding that they have been repeatedly increased during the past twelve months. The rates paid to mechanics, for instance, are, and were, 4s. 5d. for an eight-hour shift at the beginning of May of the present year on the basis of the then rate of exchange, which is the only true measure of the value of the wages as compared with those paid in other countries. The price of coal was, and still is, considerably cheaper in Germany than in England and perhaps also in America; shipping rates from German ports to South America are considerably lower because the wages paid to the crews are only one-third of those paid on British and American ships—it is even said that they are much less than one-third—the consequence is that the Germans either alone or in conjunction with their Dutch shipping friends are able to transport cargo at rates at which all other shipping companies in the world would be involved in a loss. The Germans have a growing number of their own ships; they constructed over 200,000 tons last year, and as soon as they are able further to increase the number of lines in service it is believed, at least in Scandinavian shipping circles, that they will secure a considerably greater amount of the carrying trade of the world, because under existing circumstances they can run their vessels on a much more economical basis than the shipping companies of any other country. It is of no use blinking the facts; the Germans are out to win if possible, by "peaceful trade penetration" what they failed to achieve by force of arms. Let us take, for instance, the German trade returns, the tardy publication of which has now been resumed by the Statistical Board of Berlin. Leaving out of consideration the question of values, which would be misleading under the present depreciated condition of the mark, the official German figures show that while the imports of machinery and of electrical manufactures in the eleven months ended with last November amounted only to 5,263 tons, the exports of machinery in the same period totalled 344,900 tons, and those of electrical manufactures reached 60,700 tons in the same term of months. And we see no reason for refusing to accept these statistics as representing the actual turnover of the foreign trade of the country. It will be impossible until a later date to ascertain what proportion of these tonnages was sent to South America or what tonnage has been also forwarded there in the present year. On the other hand, unofficial figures, given in values, purport to show that the Germans exported to Russia insulators for 4,700,000 marks, electric lamps for 20,300,000 marks, and wire and electrical

equipment for 2,500,000 marks between May and December last year.

It is impossible not to conclude that the Germans are making a big bid to recover and develop the export trade in general and the South American market in particular. The South American branches of the German banks have been at work for a long time past, and one—the German Transmarine Bank—has just declared a dividend at the rate of 30 per cent. The German branches of the mechanical and electrical manufacturing works are actively pushing business, and every German merchant is an assiduous promoter of German trade, whether on the coast line or in the interior, while the electricity supply companies in which German concerns still have interests are active in the advancement of the sale of German plant and apparatus. In this connection we have yet to learn that the transfer to Spanish ownership of the various undertakings of the German Transmarine Electricity Co., and of its ramifications, will make any change in the furtherance of the use of German plant by these different works and departments or whether Spanish manufactures will now be put forward as substitutes. It must also be remembered that the German home works are lavish in their expenditure on the preparation of detailed schemes and estimates and drawings of proposed installations at mines and industrial works in accordance with the requests which they receive from their branches in South America.

The question now arises where British firms come in. It is a very big problem. Unless branch houses are established or extended in South America, or the services of British engineering firms already on the spot are secured, and they are treated in a very liberal manner, it seems hopeless to expect to do a large amount of business by correspondence. Engineering travellers occasionally visiting branch houses when the latter exist, and making a series of calls upon clients or prospective customers are all very well, but the people who will actually transact the business are those who can get and keep in touch with the industrial establishments which are being erected or modernised, the owners of which can only treat with local and qualified representatives, while the showroom business would be a further advantage for the development of trade. It is only the men on the spot who can make the necessary inspections and gain the essential details in the case of possible large contracts in order to prepare or obtain from home the specifications and estimates so as to secure the orders. All these matters mean money, and unless a liberal policy in this respect is adopted we must not be surprised if the Germans get a stronger hold on the South American market. In conclusion, attention may be directed to the resolution which was passed at the recent meeting of the Association of British Chambers of Commerce urging upon the Government the desirability of Government participation in the Brazilian Centenary Exhibition. During the course of the discussion, Messrs. R. Wichello and G. Marr, of the Brazil Chamber of Commerce, and Mr. G. H. Cooper, of Uruguay, put forward strong advocacy that British traders should take part in the exhibition on the ground that if they failed to do so, the effects on British trade in South America would be very detrimental.

Electric Castles in the Air.

Our reference last week to the credulity of the lay Press was promptly illustrated, after the journal had left our hands, by a leaderette in *The Times* under the above title, supporting the assertions of one of its correspondents, who betrayed a pathetic ignorance of the facts regarding the London Inquiry. Nothing can be more certain, from the evidence brought forward, than that the local authorities, and the Joint Electricity Authority, will *not* embark upon an enormous outlay for new capital stations within the next few years; yet "London Elector" declares that every one of the "grandiose" schemes before the Commissioners involves "enormous sums of capital expenditure," and that Parliament instead of passing the Electricity Bill would properly say: "Carry on as best you can under existing conditions until times improve." *That is exactly what the schemes propose to do.* But "London Elector" says: "How utterly unbalanced and untimely, therefore, are these extravagant notions of the Electricity Commissioners and the Ministry of Transport"! and *The Times* dutifully elaborates the theme, stating that "four new capital stations are to be erected in the first stage, thirty-four existing stations are to be progressively closed," and so on. It indicates a proposed expenditure of £13,050,000 in the next four years, and a further £30,750,000 by 1930, and states that "public authorities will not dare to borrow the necessary capital."

In point of fact, the main technical scheme involves an outlay of only £1,050,000 by the Joint Electricity Authority within the next five years, and the whole tendency of the proceedings is towards restricting capital expenditure to the minimum. Capital will have to be spent, in order to meet the increasing demand, in any event—Bill or no Bill, Authority or no Authority—and the problem that is being solved is how to economise in every possible direction, but especially by co-operative action.

In one respect, it must be admitted, *The Times* and its correspondent are in the right—where they criticise the heavy cost of the Inquiries. Unfortunately the conduct of the proceedings is largely in the hands of counsel, able indeed, but myopic; with meticulous care they fasten upon points of insignificant detail—such as, for example, the fact that a public footpath runs across the Beckton site—and labour them *ad absurdum*, wasting time and money in the process. Such points are utterly unimportant—what is wanted is the broad view of the service of the public interests. The question whether the Gas Light & Coke Co. would feel comfortable with an electric super-station erected on its premises (seven years hence) was the subject of irrelevant conversation—the Gas Company and the electricity companies were quite happy about it. In such discussions time passes pleasantly but unprofitably. The Inquiry is now in its fourth week, and may go on for another fortnight according to present indications, and there is no doubt that the expense is out of all proportion to the work accomplished.

The National Joint Board.

The fact that the Electric Supply Commercial Association has dropped out of the National Board leaves the Board now exclusively representative of the technical staffs through the E.P.E.A. Seeing that the inclusion of the clerical staffs was the chief cause of opposition to the National Board on the part of a very large number of undertakings, there is now an opportunity for the Board to get on a better footing, and to secure, at last, the establishment of District Boards throughout the country. At present only a few districts have such Boards to deal with technical staff matters. London itself has no Board. An effort should certainly be made to get the whole matter properly systematised, since it is only looking for trouble to wait till difficult questions arise before providing the organisation. It will be remembered that practically the whole of the last widespread dispute with the E.P.E.A. leading to a universal threat to strike was due to the absence of any local machinery such as District Boards which could have adjusted the numerous queries and misunderstandings. And a further warning that it is time to regularise the Board is the suggestion recently made by the General Purposes Committee of Hackney that the technical staff should be included under the District Councils; that is, the engineers and workmen would sit side by side in the same Whitley Council. This is disapproved in all quarters, including, we think, the E.P.E.A. Everything, therefore, points to the necessity of at once fully organising the National and District Boards on a permanent basis.

D

SOME ELEMENTS IN THE DESIGN OF LARGE FUSES.

By "A CENTRAL STATION ENGINEER."

IF one should ask "What most makes for progress in national, scientific, or other matters?" the answer might well be: "The proper and comprehensive understanding of elements." Most great advances in knowledge arise from an intimate understanding of facts which are elementary and fundamental, and most of our stupidities arise from a refusal to acknowledge truths which ought to be self-evident. The calculus was discovered by men who got to grips with the elements of curves, and Whitworth's great invention of the method of making plane surfaces by scraping, was also elementary. These two inventions made revolutions, the effects of which will be felt when the Russian Revolution is a

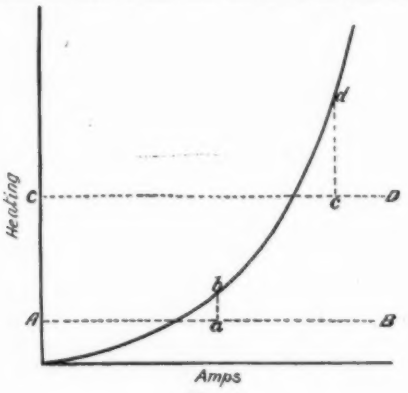

FIG. 1.

vague memory. Conversely our nation is now impeded by the belief, held by multitudes of people, that the less work a man does, the more wealth there is for everyone.

These ideas are not truisms, at any rate, to the writers of text-books. They mostly believe that the word elementary connotes something easy. "Very elementary," says the learned man, as he turns away to something worthy of his metal. If writers could get out of that attitude, they would put into their books a great deal more explanation of what the elements really mean, and more people would understand them. It should be the constant aim of thinkers to state their advanced conclusions in terms of the elements. This is not easy, as one may find on reading Einstein's work on relativity, which is profoundly elementary, but it makes for clearness of thought.

The elements of fuse design are easy, up to a point, but they have been neglected, for which reason many of the designs for large size fuses are so bad that most engineers have come to the conclusion that they must be replaced by oil breakers, even for 400 volts. This has increased costs, and it has hindered the development of electricity.

To get to business, let us consider a fuse for a normal current of 500 amps., say, at 400 volts a.c., with abundant power behind it. The ordinary design for this will consist of a porcelain handle, with a tube filled with fuse wires, so congested that there is very little ventilation. The heat generated, at normal loads, must escape the best way it can through the end pieces and through the tube, and as the facilities are small, the current density will be low. Let us suppose the drop of pressure is .1 volt. It may be less. The loss at 500 amps. will be only 50 watts. At 100 per cent. overload, the loss will be 200 watts, and at 2,000 amps., it will be only 800 watts (allowing nothing for the increased resistance of the hot fuse which would improve matters somewhat). It is evident that the melting would be far from instantaneous, even at the highest load mentioned.

Let us redesign the fuse, placing the strands well apart, in separate tubes, with ample ventilation. We may increase the drop to .2 volt, when the loss at full load will be 100 watts, at 1,000 amps., 400 watts, and at 2,000 amps., 1,600 watts. The heat is further concentrated on half the volume of metal. Even with the greater cooling facilities, the temperature will rise more rapidly, and the fuse blow with more certainty. The smaller amount of metal, spread over a larger volume, will also blow with less explosive power, and there will be less tendency to arc over. The extra loss in running may be partly compensated by making the fuse shorter than in the first design.

We now come to the operation of the square law of heating. To give a full description of the rise of temperature, we must also know the law of cooling for any particular fuse. This seems to be a subject which might be explored by the young lions in our technical colleges. I will, however, put forward a suggestion, which may not be accurate, but it will serve to arouse attention. In fig. 1 the curve represents the heat generated with the various currents. The line A B represents the amount of heat which the fuse can get rid of continuously, without the temperature of the fuse wire rising above the safe limit. If we assume (for simplicity) that the fuse radiates this amount of heat even at the higher temperature of the fuse, it will be seen that the increase of temperature beyond A B will be relatively slow. If we increase cooling facilities so that we may increase the current to the position of the line C D, it will be seen that the rise of temperature of the wire will be now much more rapid when the current increases on overload. Even when allowance is made for the more rapid escape of heat at the higher temperature, one may reasonably suppose that the fuse which is run at a high density will melt more quickly and with more certainty than one run at a low density. Not only will this be so, but with its good ventilation, it will be cooler at normal loads.

A simple calculation will show how it comes about that a rush of current of extreme violence may get through a fuse before it blows. Let us suppose that

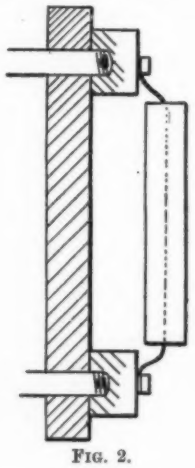

FIG. 2.

FIG. 3.

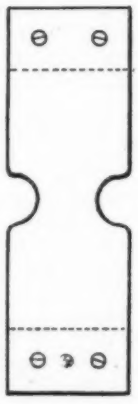

FIG. 4.

the fuse consists of six No. 16 S.W.G. copper wires, about 8 in. long, and that there is a sudden passage of 100,000 amps. (In one case, such a fuse was put right across a large battery, and there was reason to believe that some such current actually did flow, for an instant.) At this load the drop of pressure across the fuse would be about 28 V, so that the kW would be 2,800. In one second about three-quarters of a kilowatt-hour would be consumed in heating the fuse. Just how soon this rate would serve to vaporise the metal I do not know, but the amount of the energy used in the fuse at this enormous current is much less than one would imagine at first sight. The method of calculation should be useful for working out the time lag in fuses under varying loads.

It might be thought that such a rush of current would be impossible. It would certainly be rare, but on present-day large power systems, with big transformers, the possibilities of large current rushes are enormous, particularly if the fault occurs close to the transformer and near to the generating station. Some of those who have been fortunate (?) enough to witness the effects of current rushes at close quarters, can give graphic accounts of what it all means. They do not usually wish to repeat the experience.

To make the subject controversial, let us consider some actual types of fuses in common use. The really bad fuses are those which consist of a bundle of wires, bunched together in a porcelain handle. The space is so filled with wires that there is little ventilation. The fuses become hot at low densities, which means that far more metal must be used than is desirable. On short circuits, they pass enormous currents, and when they do go, they blow with explosive effects. When they are of the clip replaceable type, with fixed ends, which are not self-aligning, they may be trusted to heat in the clips also, thus adding to the delight of the user. The type is all too common, and need not be illustrated.

A good fuse should run cool at normal loads, and should melt suddenly and break the circuit without arcing. This suggests that lead alloys should be suitable. They might be suitable if the resistance were not so high that too much bulk of metal is required, at any rate, in long break types. In enclosed fuses, lead alloy is used, but its length is kept short, and the arc is suppressed by dust, liquid, or other means. These seem to break the arc satisfactorily, but they have other defects, with some of which I have dealt in a preceding article.*

Magnetic blow-out fuses offer attractions. The fuse is very short, and the arc is blown out magnetically. I have had some in use for years, but have never had them blown. Whether they are certain to clear the arc or not, I do not know. If they are, they should be more used. The British Thomson-Houston Co. has a fuse which consists of a piece of thin sheet metal put across a breaker. When the fuse goes, the breaker flies open, and the arc blows out on carbon terminals. The design is ingenious, and as the fuse itself is very short, it is cooled by conduction, and may be run at a very high density, without much loss of voltage. It looks attractive, but is very expensive.

Aluminium fuses have been used. It was anticipated that the metal would oxidise on blowing, and cut out rapidly. They seem to have gone out of use, and report says that they were not a success.

A design of fuse is shown in figs. 2 and 3. This consists of thin sheet metal, cut with a slight waist. It is screwed right on to a block of metal, and taken through a tube, to allow of good ventilation. The waist ought to ensure that the blowing takes place in the tube, and yet the fuse should melt for a sufficient length to break the circuit. Fuses made with a sudden narrowing of section, as shown in fig. 4, are liable to arc over, after they have melted at the neck.

The above fuses should be suitable for about 300 amps. Larger currents can be taken care of by several in parallel. The ventilation should make for cool running, while the high density should bring about sudden melting on a rush of current, and the small amount of metal should prevent explosion. Criticism is invited.

Conclusion.—This article does not pretend to be exhaustive, but it will serve its purpose if it brings forward experiences of users, be they favourable or bad.

It is suggested that fuses are primarily used to interrupt the circuit when heavy rushes of current take place. Generally they are not intended to operate for plain overload.

They should be run at high densities, with ample cooling facilities. Heavy current fuses should be split into sections. Ample exits should be provided to allow for the escape of the products of vaporisation, without danger to the attendants.

The designer of heavy-current fuses should always be invited to switch them on to a dead short circuit, with large power behind them. This will ensure that adequate care will be taken in the details.

Who invented the fuse? Does any one know? Or did it invent itself in the early days, when people did not know what an ampere was, and when they found out that a wire was too small by noting that it melted when the current was switched on? However the invention came into being, it was a great idea. We have neglected the necessary research work to make it thoroughly efficient on heavy currents, but that defect may be overcome by the expenditure of time, patience, and money. That would be readily forthcoming if it were required for horse racing or something equally useless, and why not for something sensible? If we will only take the trouble to study its little ways, the big fuse may become as good a servant as the little one, and probably far more reliable.

* Electrical Review, April 15th, 1921, p. 468.

SOME ELECTRICAL STUNTS ON A FORD CAR.

By "VOLTMAN."

As one who has owned and driven a "flying bedstead," one of many synonyms given by skittish Americans to the Ford car, the writer never failed to find plenty of fun and instruction combined in its electrical side. When Henry Ford worked out the peculiar electric ignition system as the only really fool-proof and simple arrangement to put into the hands of thousands of Ford users he probably little thought that he had opened up something new and interesting to the electrical engineer, because funny and obscure happenings will occur with it never met before with electrical appliances.

The severely electrotechnical man would hardly expect the Ford contrivance to work as a practical proposition, yet it does so, and in thousands of cases. Crude, perhaps, and elemental in its simplicity, the Ford alternator is successful because it is elemental, a circle of magnets rotating in front of a ring of copper tape coils each with an iron core. There is no rubbing contact; one end of the tape goes to a terminal and the other to "frame."

Of course, one would expect that with the terrific banging and vibration the rotating ring of magnets would have very little magnetism after a week's use; yet they show little weakening even after three or four years' use, but what the magnets do is to gather "whiskers" of iron particles from the engine and gears as they wear. These "whiskers" are shot off by centrifugal force and get into the oil again and cause more wear.

Someone, however, discovered that it was quite easy to "clean shave" the magnets and wash out the troublesome "whiskers" with paraffin by sending a fairly heavy current through the bobbins, and reversing the magnetism of the magnets. Then, off drop the whiskers on spinning the engine round. For a long time no one seemed to think of the possibility of remagnetising the alternator by utilising the flux of the inductor bobbins, and consequently it proved a long and tiresome job putting a new lot of magnets in. Now, one simply plays about with a compass needle to get the right polarity, connects up a battery with a tapping key to the magneto terminal, and the operation is done without unscrewing a single nut in less time than it takes to write about it.

One of the obscure troubles the writer had experience of was a "short" or "ground" from one or more of the bobbins. It might have been caused by one of the aforesaid "whiskers" lodging behind a coil or else by a fragment of fine brass or copper wire thrown up out of the transmission case, such wire being used in the friction bands. Previously, to locate such a "short" was like looking for the proverbial needle in

a haystack. Now, one quickly finds out the existence of a "short" by a voltmeter, or even a lamp test, either being put in series with the bobbins when there will be very little current evident. The next operation is to put a few accumulator cells between the magneto terminal and frame, and in a few seconds burn out the "short," again without disturbing a screw or nut, or seeing anything of the machine, as it is, of course, all cased in.

A curious experience that puzzled the writer was concerned with the high-pressure coils which take current from the alternator and operate the sparking plugs. Frequently it was found that two and sometimes three plugs would spark simultaneously, though only one would fire. This effect was traced to magnetic leakage from one coil to the adjacent ones, and consequent induction of weak currents, fortunately too weak to do any harm to the sequence of firing.

THE ENGINEERING CONFERENCE, 1921.

On Tuesday, June 28th, Sir G. T. Beilby, F.R.S., delivered the twenty-seventh James Forrest Lecture at the Institution of Civil Engineers, taking as his subject the "Fuel Problems of the Future," thus inaugurating the Engineering Conference, 1921; the proceedings were continued on June 29th and 30th and July 1st.

Coal, Sir George concluded, was likely to remain for a long time the world's chief source of energy. Its more efficient use might be secured by more careful sorting and preparation at the mine; by the improvement of boiler firing; and by the sorting out of its combustible constituents into fuels of higher availability or convenience by preliminary carbonisation carried out either at high or at low temperatures. This had an important bearing on the development of home sources of fuel oil and motor spirit, and on the production of smokeless solid fuel for domestic purposes. Expressed in tons, the oil output of the world was 7 per cent. of its fuel; in therms, it was 10 per cent. Sir George examined the position of fuel alcohol, and said that until alcohol could be made from waste materials which could be collected and treated at small cost, it did not seem likely that Empire-produced alcohol could be imported into this country on any considerable scale. The production of alcohol on a really large scale as a motor fuel of high availability bristled with economic and technical difficulties, and it was still too soon to pronounce an opinion on the possibilities of the future.

On June 29th the president, Mr. J. A. Brodie, opened the Conference, and welcomed the delegates from the American Engineering Societies. Thereafter Dr. Ira N. Hollis, past President of the American Society of Mechanical Engineers, presented to him an illuminated address expressing sentiments of goodwill and fraternity towards British engineers, and looking forward to the close association of all the English-speaking nations for the welfare of the whole world.

Mr. Ambrose Swasey, chairman of the John Fritz Medal Board of Award, then presented to Sir Robert Hadfield the medal which the deputation had been commissioned to hand to him. In response, Sir Robert remarked that the distinction was intended not only for himself, but as an expression of the high regard and appreciation of the engineers of the United States for the work of British engineers during the war, for the preservation of civilisation, and he welcomed this cheering message as a happy portent for the future of the race.

In acknowledgment of the high distinction conferred upon him, he distributed an "Address of Thanks" in the form of a most interesting brochure of some 40 pages, dealing with a variety of subjects, such as the work of British and American engineers during the war, the history of the John Fritz Medal, the invention of manganese steel and low hysteresis steel (the latter is estimated to be saving at least £7,000,000 a year to the world in cost of coal alone), and the growth of science in general, with many portraits of men of note in connection with science and engineering. Sir Robert's own portrait, however, was not included in the brochure, and we have pleasure in supplying the deficiency.

Sir Robert Hadfield is so well known in the electrical world, which has derived incalculable benefit from his work, a benefit, moreover, which increases as the years go by, that he needs no introduction; we shall content ourselves, therefore, with remarking that he has been awarded the John Scott medal and premium for the invention of manganese steel, and the Elliott-Cresson gold medal for metallurgical advances, by the Franklin Institute; three gold medals by the Société d'Encouragement pour l'Industrie Nationale of France; the Telford and George Stephenson gold medals and premiums, and the Howard Quinquennial prize and James Forrest premium by the Institution of Civil Engineers, and the Bessemer gold medal by the Iron and Steel Institute.

Sir Robert A. Hadfield, Bt., F.R.S., M.Inst.C.E., M.I.E.E., &c.
Photo by [*Swaine*

He is, of course, a Fellow of the Royal Society, and has been Master Cutler of Sheffield, his birthplace, besides president of numerous scientific bodies. His family, of Derbyshire origin, has for generations been connected with Sheffield, to which Sir Robert's own work has brought not only honour but also a large measure of prosperity.

The complete series of papers numbered 53, but we can here deal briefly with those of an electrical or allied nature only.

The proceedings were divided into seven sections, respectively: (1) Railways, roads, bridges, and tunnels; (2) harbours, docks, rivers, and canals; (3) machinery; (4) mining and metallurgical processes; (5) ship building; (6) waterworks, sewerage, and gasworks; (7) electricity works and power transmission. Unfortunately, an error was made in printing the programme which led to some confusion in connection with the reading and discussion of some of the papers, which occupied the mornings. During the afternoons visits were paid to a number of works, including the Stonebridge Park electricity station of the London and North-Western Railway Co.; Messrs. Siemens Bros.' works at Charlton; the Lots Road electricity station of the London Electric Railways, Ltd.; Messrs. Fraser and Chalmers's works at Erith; the Wimbledon electricity station and repair shops of the London and South-Western Railway Co.; and the automatic and trunk line telephone exchanges of the General Post Office.

Low Power Factor.

BY R. O. KAPP, B.Sc. (*abstract*).

The principal disadvantages of a low power-factor from the supply engineer's point of view are:—

1. The capital cost of the electrical part of an undertaking is inversely proportional to the power-factor. If the cost of this part is £15 per kVA of maximum demand (a moderate figure) this becomes £18.8 per kW of maximum demand at a power-factor of 0.80. So the bad power-factor necessitates an additional expenditure of £3 8s. per kW. The capital charges on this at 15 per cent. are 137 pence per year. If the load-factor is 25 per cent., a maximum demand of 1 kW represents about 2,200 kWh sold per year, and the bad power-factor costs 0.062 pence per unit. If the tariff was worked out on the assumption that the average power-factor would be 0.8, it would pay the undertaking to offer a rebate of anything up to, roughly, five shillings per 1,000 kWh to any consumer improving his power-factor to unity.

2. Wherever the station busbars are sub-divided by reactances and power has to be supplied from one busbar section to another (the normal working condition) with a bad power-factor the regulation is very bad and the alternators on the more heavily loaded sections supply an undue proportion of wattless current, so that the alternators on this section, if designed for the average power-factor of the system, are fully loaded while the steam turbines are not. The result is high steam consumption.

3. Wherever a district has a high-voltage supply through step-up and step-down transformers, the fluctuation of the consumer's voltage is greatly increased by a bad power-factor. So a consumer having a bad power-factor becomes a nuisance and an expense.

4. Unless special methods of power-factor improvement are installed the light load power-factor is considerably worse than that at full load on most installations. A low power-factor has also other minor drawbacks, such as increased distribution losses.

To be effective, power-factor improvement must be carried out on the consumer's premises. There is no technical difficulty about this. The difficulties of supervision and divided responsibility make it undesirable for the supply undertaking to pay for devices which are accessories to the consumer's plant, and so the problem for the supply engineer is to devise a tariff which will cause the consumer to install such devices.

To be effective, such a tariff must make sufficient difference between the electricity bill for a good and a bad power-factor to make it worth the consumer's while to effect the necessary improvement; it must be simple and free from ambiguity; the consumer must be convinced that it is fair. It should be based on integrating or recording instruments rather than on indicating instruments, as the latter type of instrument may be giving anything but a fair average figure at the time when it is read. It must be possible to determine the quantities for which a charge is made with accuracy, and the instruments for doing this must be inexpensive.

A method of charging frequently employed is a slight extension of the usual two-part tariff. The power-factor is under the consumer's control; generally the load-factor is not. A tariff which deals jointly with both is not likely to make it sufficiently obvious to the consumer how he can reduce his bill by installing power-factor improving devices. Other more direct methods would appear to meet the case better. One such is the well-known Arno tariff. This is a charge per unit consisting of two parts. The first part covers the works costs and as much of establishment charges and capital charges on the non-electrical part of the undertaking as is to be paid for by power consumers. The second part covers the capital charges on the electrical part of the undertaking. The cost of the electrical part was assumed above to be £15 per kVA. The capital charges on this are 540 pence a year. At 25 per cent. load-factor and unity power-factor, the sale of kWh is 2,200 per year. This is 0.25d. per kW-hour. Let the first part of the tariff be 1d. per kWh. The total charge would then be 1d. per kWh plus 0.25d. per kVAh.

At unity power-factor the consumer would pay 1.25d. per kWh; at a power-factor of 0.8 he would pay 1.312d. per kWh. That is to say, he would pay the 0.062d. more that his bad power-factor costs the undertaking. A single meter is used in connection with the Arno tariff which integrates kW hours, plus a fraction of kVA hours, so that the bill can be based on a single reading. A modification of this tariff was suggested by Mr. Barbagaleta in a communication to the Italian Association of Electrical Engineers, and later independently by Mr. C. G. Carrothers in the ELECTRICAL REVIEW,* in which two standard watt-hour meters are used, and a simple computation from their readings gives a very close approximation to the Arno charge, which is the scientifically accuracte one.

All these methods suffer from one drawback. The consumer is paying for something of which he does not get the benefit; that is, he is paying in one way or another for the idle component of the power. No doubt if supply undertakings start an educational campaign consumers will eventually understand that such charges are not only fair, but to the interest of everyone concerned. They will find it much easier to understand this, however, if the adjustment takes the form of a bonus for a good power-factor rather than a penalty for a bad one. It is suggested that tariffs should be based on the assumption that the average power-factor will be 0.8. It is reasonable to expect consumers to have a power-factor of this value without any special appliances, so very heavy penalties may be exacted for values below 0.8. If the consumer improves his power-factor above 0.8 the supply undertaking should allow a bonus of so many pence per 1,000 kWh for every 1 per cent. by which the average power-factor as shown by the readings of two standard integrating watt-hour-meters is improved.

DISCUSSION.

The CHAIRMAN, Mr. Ll. B. Atkinson, opened the discussion by explaining that the problem was a very real one, and briefly referring to several methods of improving low power-factor. All of them, however, except the use of the over-excited synchronous motor, involved the provision of extra appliances. This country had not devoted sufficient attention to the production of an a.c. commutator motor, which he thought would solve all their difficulties. That type of machine had been developed considerably in the U.S.A., and it was probable that if the author's suggestions were adopted they would stimulate the revival of interest in unity power-factor motors.

Dr. S. P. SMITH pointed out that the subject was pretty well understood technically, but "machine men" wanted the help of station engineers. The subject had been rendered more acute by the prevalent high costs. France had given the matter more serious consideration of late, and it should be understood that the consumer in some way or other paid for low power factor in the end; therefore, to make him rectify it was the most fair method. The rectifying apparatus might need more skilled attention than was given to the consumers' ordinary motors, and that point must be considered before tariffs were adjusted. He thought the use of reactance was only transitory, and they might attain a point where it need no longer be employed. The speaker was very pleased to hear the chairman draw attention to the a.c. commutator motor, because with that type of machine they could do practically anything they wished, but not with the induction motor. He thought the bad feeling against the a.c. commutator machine was dying away, and they must remember that speed control was only to be obtained by paying for it in some way or other. The synchronous induction motor had a future before it; where constant speed or unity power factor was required its use was the simplest way of solving the difficulty.

Mr. W. R. COOPER explained that if he were a consumer he would not care to be bothered with the installation of extra plant, but if the supply authority cared to install plant which would not bother him it was at liberty to do so. For that reason he favoured the use of condensers.

Mr. S. E. FEDDEN, after recalling some of his experiences in the early days at Sheffield, mentioned that an electric furnace was a wonderful power factor rectifier up to a certain point. Variation in power factor seemed to depend on the type of plant that was installed, but the greatest sinner was a rolling mill, and its owner should be made to pay or rectify his bad power factor. Another difficulty was in connection with switchgear; some old Ferranti switches used to break the circuit all right with a high power factor, but would flash over with a low one. He had eliminated that trouble by connecting oil switches in series with the old ones. The consumer paid in any case, which was unfair; the man who caused the trouble should be made to pay. He therefore hoped some suitable tariff would be found, and agreed that a power factor of 0.8 should be satisfactory.

Mr. W. M. SELVEY was of the opinion that there were many ways of improving power factor, all having disadvantages, but no single one with a decided advantage. There were four aspects of the case: (*a*) Technically, the apparatus was available, and there was no problem which could not be solved—at a cost; (*b*) commercially no measure of agreement on the matter had been come to at all; (*c*) from the legal

* April 1st, 1921.

point of view it was very encouraging that the British Electrical Development Association was memorialising the Electricity Commissioners with regard to the legalising of some form of suitable tariff; (*d*) the psychological aspect arose from the legal one, *i.e.*, an implied contract which was found to become onerous to one of the parties and was broken. They must get away from the flat to the measured rate of charging for electricity, but the difficulty was to get consumers to understand the latter and the reason for the change.

Mr. C. P. Sparks gave some particulars of two undertakings of quite a different character, one being an oil-field supply with a power factor of 0.5, where some form of correction was necessary at group points. A.c. winding and haulage in mining work was another case wherein it was advantageous to correct, but in both those instances the supply, distribution, and consumption were all in the hands of one concern. In the ordinary way only a certain percentage of the consumers was to blame. It would not pay to provide apparatus to correct for a very high power factor. It was very difficult to induce consumers to spend money on correcting devices which would only give them the benefit of a small bonus. He was of the opinion that it was up to the supply authorities to make the correction.

Mr. A. H. Dykes gave some particulars of methods of charging he had adopted on the kVA basis, and thought the proper place to rectify was on the consumer's premises. He had obtained good results with the use of condensers on the h.p. side with transformers on the consumer's premises.

Mr. J. R. Blaikie discussed tariffs and how they should be applied, expressing the opinion that they must classify consumers. The Creedy motor, made by Messrs. Parkinson, was a marvellous machine, and its success, he thought, was largely due to the improvement in carbon brushes and the attainment of sparkless commutation. How far did the generating station contribute itself to the low power factor? That point was particularly noticeable in stations working on light load.

Mr. R. O. Kapp, in reply, pointed out that they could maintain a power factor of 0.8 by using any reasonably good motors, but to attain a higher figure they must install special appliances. It would pay to install plant to correct up to 0.8, but it cost a great deal to reach figures of from 0.85 to 0.9. He was of the opinion that in future supply undertakings would have to provide publicity departments, not for advertising purposes, but to help and advise consumers.

Ship and Harbour Design and Equipment as affecting the Rapid Loading and Discharging of Cargo Vessels.

By A. R. T. WOODS. (*Abstract.*)

During 1920 the ports of the United Kingdom had to provide transport and handling facilities for over 100 million tons of traffic. Under present conditions the failure of the machinery provided on shore for the handling and distribution of goods to give quick dispatch, has led to fewer voyages being made and thus reduced the potential carrying capacity of the ships engaged in the foreign trade by something like 20 per cent. We are thus compelled to explore the avenue of possible improvements in the cargo-handling equipment of ships and docks.

However efficient a ship's gear may be, it is essential that it should be supplemented by good organisation on shore and also by the provision of mechanical appliances in accordance with the best practice.

It is an obvious but unpleasant truth that the majority of British dock systems suffer from want of foresight.

What we are more concerned with, however, at present is the provision of additional mechanical equipment to enable shipping to increase its earning power by a reduction of the time spent in loading and discharging. The winch and the cargo crane have been good servants in the past, but there is a tendency on the part of dock authorities to rely too much upon devices of this type. The conveyor system has demonstrated its applicability to grain cargoes and generally to what may be termed "parcel and bag" cargo. The extension of facilities of this type would prove of undoubted value in increasing the rate of discharge. Double-storey sheds equipped with roof cranes which have done such good work at Liverpool should be more generally adopted. Simultaneously with discharge into the sheds cargo can be swung from ship to roadway and immediately loaded into rail trucks or road vehicles. It is only by the provision of increased mechanical contrivances for dealing with cargo that the free flow of traffic through the ports necessary to enable ships to work at full capacity can be secured. The solution must not be delayed, for upon it depends in great measure the well-being, and, indeed, the maintenance, of our overseas trade.

Development of Cranage Facilities for Discharging Vessels of Large Size.

By H. J. DEANE, B.E., M.Inst.C.E. (*Abstract.*)

Progress in cranage facilities has been parallel with the growth in the size of ships, and has been amplified by the introduction of electrical power as applied to cranes. After comparing the speeds and dimensions of the early hydraulic with a typical modern electric quay crane, the author points out that cranage facilities necessarily have to be designed to suit the shipping which is likely to frequent the port, and, in preparing specifications, a large number of considerations must therefore be taken into account. In dealing with these it is of importance to keep in view the very debatable question whether cranage equipment provided by the port authority should be reckoned as a dividend earning facility or whether it should be looked upon as a necessary expenditure which is only partly met by the revenues directly derived therefrom.

Discussion.

In the discussion following the reading of the papers contributed to Section II (chairman, Sir Maurice Fitzmaurice, C.M.G.), on the opening day of the Conference, Mr. F. E. Wentworth-Shields, referring to Mr. Woods's paper, said that he had seen the ships' winches and the quay cranes pulling cargo out of the same hatch, a fact rendered possible by the use of electrically-driven trucks to carry the cargo away as fast as it was got out.

Dealing with Mr. Deane's paper, Mr. M. F. G. Wilson remarked that there was no doubt that the electric crane was displacing the hydraulic crane everywhere, and a new installation of hydraulic cranes was now very seldom seen. Regarding first cost, there was not much difference in the prices of hydraulic and electric cranes, but the cost of laying the hydraulic pipes, installing accumulators, &c., added greatly to the cost of the hydraulic system, while, of course, the electric crane was much more flexible.

Continuing the discussion, and dealing with Mr. Deane's paper, Mr. C. R. S. Kirkpatrick said it was well known that the advantage of the electric crane over the hydraulic crane was that with the former the power consumption was directly proportional to the load, whereas the latter used the same amount of water, irrespective of whether it was working with a light or full load. Touching upon the demand of shipowners for an increased crane radius and the loss of time its adoption would entail, the speaker said that he was trying to solve the problem by a new type of crane in which, instead of travelling the load on a 60-ft. radius, he would employ a horizontal beam travelling with a small monkey crane on the top. The load would thus move in a radius of about 30 ft. only, the backward and forward motion being along a straight line. He hoped with this arrangement to speed up the slewing time by about 25 per cent.

Sir Archibald Denny, Bart., speaking with regard to cranes on ship and shore, said only one or two ports had a large crane equipment, and urged that ports should extend their cranage facilities with the most modern appliances.

The following speaker, Mr. A. T. Walmsley, also favoured the placing of cranes on the quays instead of on the ships, as quay cranes gave a greater command of trucks and rails.

(*To be continued.*)

THE THERMAL EFFICIENCY OF HEAT POWER PLANT.

At the London summer meeting of the Institution of Mechanical Engineers, which was held on Thursday and Friday last week, an informal conference took place on "Means of Improving the Thermal Efficiency of Heat Power Plants." During the two days, separate meetings were held in four rooms simultaneously, at which 16 short papers were read and discussed.

Dealing with "Engine-house Management," Mr. H. Dunell, O.B.E., referred mainly to the smaller power stations, and attributed the losses in the engine house to (1) waste of steam before it reached the engine; (2) inefficient condition of the engine. Under the first head he drew attention to leaky joints, ineffective steam traps, inadequate lagging, &c.; pointing out that, especially with superheated steam which was not visible, a leak in a steam pipe might mean a very serious loss; a one-inch open pipe could discharge all the steam that a 30-ft. Lancashire boiler could generate. To keep the joints tight, the pipes should be kept warm on light load, and there was no better lagging than magnesia. Steam traps were a source of loss, and he preferred plug cocks for intermittent drainage, where possible, with periodical attention. The discharge from traps should be visible, and they should receive constant attention. He preferred the flotation type.

Turning to the engine, while reaction turbines retained their efficiency for long periods, Mr. Dunell remarked that impulse blading needed inspection to detect erosion. Indicator diagrams of reciprocating engines should be taken periodically, to reveal hidden defects. Mixed-pressure plant needed most attention; oil should not be allowed to coat the blading of exhaust steam turbines, and if it was found it could be cleaned off with paraffin followed by a steam jet. Surface condensers should not be neglected for long; the scale could easily be cleaned off in the early stages, but when it attained a certain thickness it developed rapidly. Warm caustic soda solution was useful for removing it. River steamers in the Far East, using sandy water, had clean condensers, and he asked whether sandy water could be used with advantage here. Periodical running tests of the plant should be made and used.

Mr. Gillespie said that between magnesia and clay there was a very large range of efficient coverings; magnesia was the best, but others were good.

Mr. Martlew emphasised the importance of a proper lay-out of the steam piping; some arrangements invited leakage owing to the inadequate provision for expansion. In some cases a cold blast of air from a window would be found blowing across hot pipes. Water was liable to cause blade stripping in turbines; oil should also be kept out of them. He had found an electrical method of removing oil both effective and inexpensive. He was dubious as to the use of hydrochloric acid for cleaning condensers. The metering of steam, water, electricity, &c., was very desirable, but unfortunately steam flow meters were very costly.

Mr. Edwards, referring to the author's advocacy of indicator diagrams, said there were all sorts of losses outside the engine which could only be found by keeping records. As a case in point, he mentioned a heavy loss which was traced to steam traps discharging underground; by converting them to discharge above ground, in sight, a saving of £1,000 a year was made. By laying steam pipes in trenches, covered with loose fossil meal, as good results were obtained as with magnesia. Perfect separation of oil from exhaust steam had been effected with an oil separator followed by three old Lancashire boilers in series, used for thermal storage; there was not a trace of oil on the turbine blades after two years' use.

After other speakers had taken part in the discussion, the chairman, Mr. F. H. Livens, remarked that the ability of the reciprocating engine to run on from year to year without revealing defects would seal its doom; the internal-combustion engine called for immediate attention when anything went wrong. Routine records might be troublesome and of little service, but frequent tests of individual items of plant led to great savings, and the indicator was a very valuable aid. Impurities in the working fluids—water, steam, and oil—were the source of many losses.

In reply, Mr. Dunell said that with magnesia two inches thick, only 7 per cent. of the heat passing through a pipe was lost. Steam pipes were continually spewing scraps of scale, &c., which got under the valves of steam traps and caused waste. He doubted the advisability of placing pipes out of sight in trenches.

A paper on "High Steam-pressure and other means of Increasing the Economy of Steam Engines," by Mr. F. Samuelson, was read in the author's absence by Mr. Halliwell. Pointing out that the present methods of generating power with steam were very inefficient, the author said that improved efficiency was most readily obtained by increasing the range of working temperature; the addition of a mercury boiler and turbine * to an ordinary steam plant considerably raised the range of temperature and resulted in a saving of 40 to 60 per cent. In laying down new plant, the easiest method of increasing the temperature range was by superheating the steam, raising its pressure, or both. Data were given showing the comparative efficiency ratios corresponding with various initial pressures and temperatures of steam. The practical limit of working temperature was 800 degrees; hence they must resort to higher pressures. The advantages of feed-water heating, and of extracting steam from an intermediate stage of expansion for industrial heating purposes, were pointed out, but the author thought there was little overall benefit to be derived from reheating between stages. Finally, it was stated that the British Thomson-Houston Co.'s experimental plant at Rugby, working at 350 lb./sq. in. pressure and 700 deg. F., had proved quite successful, and gave an economy of over 18 per cent. The output was 5,000 kW, and the maximum temperature 750 deg. Trouble was experienced at first due to the use of brass spacers in the turbine blading, but this was overcome by the use of steel. Complete tests had not yet been carried out.

Mr. S. E. Fedden, commenting on the mercury vapour turbine, referred to experiments in Berlin some 15 or 16 years ago, and asked whether it had not been found that leakages of the mercury vapour were very dangerous. The diagram of the mercury vapour plant at its present stage of development looked rather like that of a toy. Dealing with the curves provided with the paper, Mr. Fedden pointed out that the gain in efficiency at the high pressures and temperatures was small, and suggested that the increased capital and running costs might easily swallow up the saving. He would not go above 700 deg. Steel economisers and a pure water supply would be necessary, and there were many details to consider before advancing to the higher figures. What was the effect of "bleeding" the turbine on the efficiency of the whole plant? One might lose as much as one gained, and he called for proof regarding the total efficiency between the coal fired and the switchboard. He had used air heaters for 20 years, and found the cost of maintenance was high; in one case the increased furnace temperature burnt the fire bars, and much of the hot air to be by-passed.

Mr. W. M. Selvey said Mr. Emmet's work was now pretty well known, and the use of two working fluids had often been tried; in the long run the saving made in one way was lost in another. But they must not always turn down new proposals; experience must be gained with them before progress could be made. Steam pressures had been raised to 300 or 350 lb. years ago, but when boilers generating 100,000 lb. of steam per hour were in question, mechanical considerations became important. There was no inherent difficulty in working at 350 lb., and the North Tees station was using 475 lb. pressure with promising results; but there was a limit to the permissible temperature, and manufacturing firms were not prepared at present to go far above 700 deg. F. The use of high-grade heat for feed-water, and heating the air supply, upset the delicate balance of temperature on the grate bars, and they must be very cautious lest attempts to obtain increased efficiency led to increased cost of maintenance.

Mr. Oxley thought they were all moving in a groove in search of improvements of ½ or 1 per cent. efficiency; could they not strike away from customary methods? In this sense the attempt to use mercury vapour at high temperatures was worthy of serious consideration. Endeavours to improve steam or gas engines depended upon the materials available, and only led to gains of one or two per cent. The material of construction of a turbine for mercury vapour was a matter of great importance. It was generally held abroad that to go beyond 350 lb. and 750 deg. was very questionable, and even those limits were somewhat risky, owing to the qualities of the materials. At 750 deg. the live steam parts of the turbine began to glow in the dark.

Mr. Rolph said that cast-iron of greatly improved qualities was likely to be available shortly, and researches on turbine blading, &c., were in progress.

Mr. L. M. Jockel had hoped for more data about the mercury vapour system. He referred to the very interesting installations at work at Dalmarnock, and in progress at Necnells and Barton, and drew attention to the important opportunities for improving efficiency at the low-temperature end of the steam cycle, where the difference of 5 deg. between the exhaust steam and the condensate meant a heavy loss of energy. Great waste occurred in condensing plant; he had tested various condensers, and got the best results with the Kinetic Contraflo type, which with a radial flow reaction turbine made a good combination.

The chairman, Mr. R. W. Allen, C.B.E., referred to the use of 300 lb. pressure in the Navy; no difficulty was met with in obtaining boilers for this pressure with low superheat—the difficulties came in with high superheat. The war had taught them what could be done by research; at Sheffield they produced the special steels required for aeroplane engines in a few months, and if these high pressures were necessary, they should get Sheffield to solve the problem.

Replying on the discussion, Mr. Halliwell said the paper, limited to 1,000 words, was only a guide-post for the discussion on economy. The 1,000-kW mercury-vapour turbine could hardly be regarded as a toy. It was a useful size to experiment with, and was driving part of the General Electric Works. The joints in the mercury pipes were mainly welded, and leakage was taken care of. With regard to the use of steel tubes and pure water, it was the gases in the water that created the worst troubles in these high-pressure and high-temperature plants, and they must keep air from the feed water. As Mr. Selvey said, the troubles were mostly mechanical, and it was up to mechanical engineers to overcome them. In turbine work 500 deg. F. was the limiting temperature for cast iron; for higher temperatures steel was necessary except for the blading, which was of phosphor-bronze. Mild steel was satisfactory up to 800 deg. The troubles so far met which were not due to the materials, but to the novel mechanical conditions.

(To be continued.)

* The Emmet mercury vapour plant was described in the Electrical Review of October 22nd, 1920.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Dover Corporation Electricity Works and its Staff.

The timely letter of "R. W." with regard to the above in your last issue should serve to call the attention of all electrical engineers to the reprehensible course of action which the Dover Corporation proposes to adopt.

In December of last year this Association received a definite promise in writing from the Corporation, to the effect that it intended to put into operation the schedule of salaries as issued by the National Joint Board. The recent decision of the Corporation to throw over the schedule and to effect such drastic reductions in the salaries of the technical staff is a direct violation of that promise, and is calculated to give a staggering blow to one's faith in the integrity of public authorities.

One frequently hears criticisms of the lack of faith shown on the part of employés, and of their failure to honourably carry out agreements to which they were parties, but surely it would be hard to find a parallel to the decision of the Dover Corporation.

If the Dover Corporation feels that the present payment of the schedule is bearing hardly upon it, there exists in its district area the constitutional machinery in the form of a District Board at which its grievances could be ventilated, and, if substantiated, could be corrected. To ignore that machinery is to undo all the good work that has recently been done in the conciliatory machinery and uniform methods of negotia-

tion, and to bring about a reversion to the old bad methods of individual bargaining.

I may state in reply to your correspondent that the Association *does* propose to take prompt and firm action in the matter, as it recognises that this is a test case, and that if the action of Dover is allowed to pass unchallenged, there will be no end of the same thing throughout the country. The first stone must be arrested, otherwise there will be an avalanche.

Steps are being taken by the Association to warn all its members against even applying for, still less accepting, the positions at present occupied by our members when they become vacant, and it ventures to hope that other engineers who are outside the ranks of the Association will refrain from applying for the positions, and so impress the Dover Corporation with the sense of the folly of its contemplated action. If all electrical engineers will take a proper view of the matter and refuse to accept positions, the Corporation will be forced to reconsider its decision.

W. Arthur Jones,
General Secretary, E.P.E.A.

London.
July 4th, 1921.

Correspondence re the E.P.E.A.

Almost every week one is presented in your "Correspondence" columns with a whole sheaf of letters written by aggrieved members of the E.P.E.A.

I think it is high time these "grousers" desisted from fighting one another and anybody and everybody in general through the medium of your columns, and loyally supported their Association. If they are not satisfied with their executive, then why do they not go to the Association meetings and stand and deliver themselves of all their woes? Perhaps they have not the pluck to face it out, but must resort to a *nom-de-plume* in your "Correspondence" columns.

I am not a member of the E.P.E.A., as I am not in the supply industry, and therefore have no axe to grind; it is merely that this correspondence makes me tired, and I should welcome something of more general interest.

May I suggest that correspondence *re* the E.P.E.A. should only be published if the writers give their names, as it seems to me a very back-handed action to slate the Association under a *nom-de-plume*.

E. W. Dorey.

London.
July 2nd, 1921.

Sawdust as Fuel.

Could any of your readers inform me of any process, briquetting, &c., by which saw-dust can be used as fuel, either for domestic or steam-raising purposes?

Tom C. Sehneidau.

Wolverton.
July 2nd, 1921.

[An installation of 200 h.p. driven with gas from wood-refuse at a timber mill at Maldon, Essex, put down by Mr. H .P. Girling, was described in our issue of December 27th, 1912. A Swedish installation of similar type was described in our issue of April 16th, 1915, and a sawmill plant where the refuse was burnt under boilers, to the designs of Mr. W. Worby Beaumont, in our issue of April 7th, 1916. For briquetting methods we must appeal to our readers.—EDS. ELEC. REV.]

Charges for Service Mains.

I would like to ask your readers, through your valuable journal, why the South London Electric Supply Corporation makes such excessive charges for outside mains leading to new consumers' premises. Could not this be covered in the price charged per unit? If the late war has brought about these charges, then let the pre-war consumers, who were lucky enough to miss these mains charges, bear some of the costs of their less fortunate brethren. It is obvious that these charges for outside works must be holding up wiring contracts, to the benefit of gas companies.

I should like to learn of the experiences and opinions of wiring contractors on this very important subject.

Disgusted.

June 28th, 1921.

Technical Books.

"L. W. C.'s" inquiries in to-day's issue of your ELECTRICAL REVIEW are answered capably in part, but no single book can "completely" represent the practice in any branch of engineering which is daily advancing. The student, to fit himself to handle any practical problem, must not be satisfied with the opinion of any individual, but must learn to cull from many writers their ideas and methods; and then select therefrom what best suits his particular needs in any specific case.

A cyclopædia by experts leads one to more specialised writings on each particular subject, *e.g.*, I have no hesitation in commending to "L. W. C." books dealing practically with the fundamentals of electrical engineering in England such as F. M. Denton's "C.C. Armature Winding"; H. E. Poole's "H.T. Switch Gear" and "Switchboards"; A. E. Clayton's "Power Factor Correction"; and A. P. Trotter's "Elements of Illuminating Engineering," but these are not encyclopædic. They are modest in price and size, and excellent in contents.

Theodore Stevens.

London.
July 1st, 1921.

A Contact Arc Splitter.

With reference to your article on page 834 of the ELECTRICAL REVIEW of June 24th, 1921, regarding a contact arc splitter which, we note, you state has recently been developed by the Westinghouse Electric International Co., of East Pittsburg, Pen., U.S.A., we should like to point out that this has been a device which we have fitted on circuit breakers in cases, and, as a matter of fact, on all the Admiralty circuit breakers which we have supplied for the British Admiralty during the last nine years, so we feel that the device shown is not new in any way. We enclose herewith lithos which we have torn from a pamphlet which we prepared some years ago for use in the Navy, which shows the arc splitters as mounted on our circuit breakers, and which you will see, on referring to your diagram in the ELECTRICAL REVIEW, fig. 1, page 834, is exactly the same. We feel that we are entitled to any credit there may be regarding this device, and this is our reason for writing this letter.

For **Whipp & Bourne, Ltd.**
FRANK R. WHIPP.

Castleton.
June 30th, 1921.

[The arc splitter devised by Messrs. Whipp & Bourne, Ltd., over nine years ago is, as they state, a direct anticipation of the American arc splitter which we illustrated, and we are glad to know that their design was so early in the field.—EDS. ELEC. REV.]

Coal Shortage and Oil Fuel.

In reply to the letter from "One Junior Charge Engineer," first it is stated that about three times as much oil is used under a boiler as under a Diesel cylinder cover. (I take it this means per kWh.) If so, should it not be six times as much?

I am at a loss to understand several of the paragraphs, which are so inconsistent as to become almost unreadable, and I can only surmise that the experience gained it, as quoted, in a junior stage; this is certainly not the discussion looked for at this age, when we are hoping to make the best of our enormous fuel problem for the future.

I am afraid "Junior Charge Engineer" is very wide of the mark in such paragraphs as:—

Twenty minutes to get a boiler on the range.

Twenty seconds to get a Diesel on load; of course, if you miss synchronising, you may have to operate the governor gear.

I fail to see what engine-room crews lying in ports have to do with our internal power supply, and it is the first time I have heard that reliable Diesels were not built in this country.

In conclusion, I am afraid "Junior Charge Engineer" must have ill-treated the very few Diesel engines he may have seen.

S. H. Fowles.

Jarrow-on-Tyne.
June 27th, 1921.

Locality of Situations Advertised.

I think it would be a great advantage and save considerable disappointment if employers when advertising vacancies in your columns and using a box number would state whether the job is in London, the Midlands, or the North, or give some indication of the district.

E. A.

July 2nd, 1921.

The Engineering Industry in Johannesburg.

I should like to draw the attention of readers of your paper who may be considering emigration to this country to the fact that at the present moment there is a considerable amount of unemployment in the skilled engineering trades here; just now the municipalities and employers generally, including the Government, are having considerable difficulty in coping with this unemployment problem, and it is possible that the coal strike at home may prolong this present temporary slump.

It falls to my lot to interview a considerable number of men arriving from the Old Country, some seeking for employment, and others requiring licences to enable them to undertake electrical wiring work in this town.

I wish to impress upon intending emigrants that it is essential to bring out with them all available testimonials and references covering their careers from apprenticeship upwards, as it is difficult for a man to obtain employment unless he can produce a proper set of credentials to show what his experience and training have been. It is surprising how many men come out apparently with the idea that credentials and references are of no value. Licences to undertake wiring in this town can only be obtained on production of credentials proving at least five years' suitable experience, and wiring

contractors, both in this town, and to an increasing extent in other towns, give preference to men possessing the wireman's licence granted by the Johannesburg municipality.

B. Sankey,
General Manager, Gas and Electric Supply Department; Chairman, Board for the Licensing of Electricians, Johannesburg.

June 6th, 1921.

[In a subsequent letter Mr. Sankey encloses a cutting from the *Rand Daily Mail*, showing that the situation is still worse than he had supposed, and that mechanics and others should not go out to the Cape "on spec." at present. The extract reads:—

The Cape Peninsula is faced with a serious problem in connection with unemployment. The ranks of the unemployed, both Europeans and coloured, are becoming larger week by week. This is due partly to the present depression in trade, but mainly to the fact that men, skilled mechanics as well as unskilled labourers, are drifting into the city from all parts. There seems to be an impression abroad that work can be obtained. This is a mistake. They not only cannot find work, but they cannot readily obtain accommodation, for the housing problem has not yet been solved. . . . Another factor which is operating towards increasing the ranks of the unemployed is that steamers are bringing to South Africa numbers of men from Europe, who have been persuaded that work can be obtained here easily. The labour bureaux are being besieged by men, many of them good mechanics, seeking employment, and they cannot be placed.

Mr. Sankey's warning is very useful and timely. Similar comments on industrial conditions elsewhere overseas are invited, on behalf of our readers—but we hope they will be more cheering!—Eds. Elec. Rev.]

Marine Electrician.

Referring to the query of "E. R. M." in the current issue of the Electrical Review, with regard to taking up a situation as a marine electrician, I trust the following information will prove useful to the intending applicant.

In the first place, it is usual for anyone desirous of going to sea to serve an apprenticeship of possibly six months with the shipping companies' shore staff of engineers, and then as his abilities are proved, he is drafted aboard one of their vessels, as a vacancy arises.

There are several of the first-class passenger companies, the addresses of which can be obtained from any shipping office, who carry an electrician to look after all the maintenance and repairs of the electrical appliances aboard ship, and if "E. R. M." writes to the superintendent engineer, stating all his experience, and with copies of testimonials, he will no doubt receive a reply, requesting him to appear before the head engineer, for an interview.

A. Peckston.

Middlesbrough.
July 2nd, 1921.

Armature Core Bands.

With reference to "Armature's" letter in this week's Review, I experienced a similar case to that quoted, some twelve months ago.

The motor was direct coupled to a centrifugal pump running at 2,000 r.p.m. On three occasions the bands burst, which eventually necessitated the armature being rewound.

During the process of stripping, I found the coils were a loose fit in the slots, and concluded that owing to their rising, due to centrifugal force when the machine was running, a continual pressure was being exerted on the undersides of the core bands, with the result that after the machine had been running for a time the bands burst.

I increased the slot insulation, making the coils a reasonably tight fit, and encased the steel bands in a copper casing, sweating the whole up solid.

This machine has now been running continually for nine months, and the bands show no signs of slackening.

On the other hand, "Armature" may have struck a bad consignment of banding wire. Recently I had occasion to test a reel of No. 18 steel banding wire, taking three samples from different parts of the reel, and found a considerable variation in the breaking strain in each case.

I should be pleased to hear when "Armature" has overcome his trouble and what he found to be the cause of it.

Motor.

July 4th, 1921.

Electric Light Wiring Systems.

With reference to the paper on the above subject read before the National Association of Supervising Electricians, I much regret the tone of the letter of "Two Phase" that appears in your issue of the 24th inst., and quite expected to find at the end of it: "This correspondence must now cease." "Two Phase" has brought an enlightening technical discussion down to the level of acrimonious personalities.

If your correspondent cares to accept my invitation to the next technical debate of the N.A.S.E., he will find that by design they are frankly, though fairly, critical, and for that reason educational.

That supervising electricians depend in any degree upon manufacturers for their daily bread is, on the face of it, simply frothy verbosity. The Association has a long record of lectures by inventors and manufacturers, who have all been grateful for the practical criticism our members have been able to offer.

I do not agree that C.T.S. has received greater condemnation than other systems. It has been brought into greater prominence in this discussion by the frantic efforts of its disciples to justify its use under all conditions, which is a ubiquity the makers do not claim. In any case, the letter of "Two Phase" contains nothing that is illuminating on the subject. In a certain gas works in London, C.T.S. was installed in the retort houses, and ordinary V.I.R. taped and braided drawn into screwed welded tube in other parts of the works.

I have examined the job superficially in the light of these discussions, and find that there is a tendency for the sheathing to crack on the outside of sharp bends, and, of course, there is a certain amount of sag in the horizontal runs, which as far as I know can only be avoided by using some adhesive paste when erecting.

I have also examined the conduit job, and find that air and water, and possibly free gases, have attacked the tubing, and rust has practically entirely displaced the enamel. The interior of the tube appears in fair condition, but I should venture to say that C.T.S. will prove the more durable job. On the other hand, I know a small motor garage where the hand lamp lead spends most of its time in the oil and grease of the floor and pit, and after 18 months required replacing. Now, the point I arrive at is that, by this review of facts, I am not condemning C.T.S. because it cracked at a sharp bend; I shall simply see that when it is used again there is no sharp bend. Because rust heavily attacked conduit in a gas works, I shall not rule out conduit always. In a gas works I should use a sherardised tube system in conjunction with C.T.S.

In a motor garage that allows oil to be about the floor, obviously the lead must be protected by a flexible metallic tube, although even this has faults. In other words, we have gained experience.

If "Two Phase" cares to send me his address, I shall be pleased to advise him of the date of our next lecture, and, indeed, any other electrical gentleman interested.

J. H. Windibank,
Vice-chairman,
National Association of Supervising Electricians.

South Norwood.
June 28th, 1921.

National Electric Light Association of America: Chicago Convention.

With reference to the leader in your issue of July 1st, the Council of the E.D.A. has already had under consideration the possiblity of arranging for joint conventions of the various electrical interests in this country, and although the existing subdivision of Electricity Supply and other Electrical Associations has hitherto made anything of the kind difficult, yet there appears every reason to hope that with a little perseverance and goodwill we may ultimately look forward to some arrangement for bringing together the members of all sections of the industry once a year. The value of such an effort would repay almost any trouble involved in it.

As at present, working meetings and conventions of the different sections are of great benefit to the members, and to the branches of the industry represented by the several sections, but they carry little propaganda value towards the public.

Associated together in the form of a general meeting dealing with every interest comprised in the electrical industry, they would, in addition to the proper work carried out by each section, make a very notable cumulative impression on the public mind, secure the interest of the Press, and probably produce a business-getting influence out of all proportion to the cost involved.

J. W. Beauchamp,
Director and Secretary,
British Electrical Development Association, Inc.

London.
July 5th, 1921.

Birmingham Electrical Golfing Society.—The Summe Meeting of this Society was held at Sandwell Park, under idea conditions. The Baylis Cup was up for competition, this being won by Mr. J. D. Masters, with a score of 94—15=79. The other prizewinners were Messrs. W. A. Jackson, J. H. Harpin, W. A. Baxter, and G. Handley, the last-named gentleman securing the prize for the sealed nine holes. There was a representative gathering, and the event was very enjoyable.

REVIEWS.

Elementary Principles of Continuous Current Armature Windings. By F. M. DENTON, A.C.G.I., A.Amer.I.E.E. Pp. 102+x; figs. 44. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

Small Single-phase Transformers. By E. T. PAINTON, B.Sc., A.M.I.E.E. Pp. 95+x; figs. 40. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

High Tension Switchgear. By H. E. POOLE, B.Sc., A.C.G.I., A.M.I.E.E. Pp. 118+ix; figs. 26. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

These three books form a part of Messrs. Pitman's series of technical primers which is designed to provide information in the various branches of engineering technology in a cheap and concise form. The series, which is edited by Mr. R. E. Neale, B.Sc., A.C.G.I., A.M.I.E.E., comprises a set of volumes whose size is foolscap 8vo, and which are, therefore, convenient for the pocket; they are distinguished by clear printing and the diagrams are well reproduced.

Mr. Denton's book forms a comprehensive study of direct current armature windings, and is intended for use by professional electrical engineers. Many years ago Prof. Cramp suggested a method whereby drum lap windings might be looked on as being derived from ring windings; the present writer carries this idea further and shows that drum wave windings may also be looked upon as derived from ring windings of the multiplex type. Readers who have had difficulties in following the more usual explanations of the action of wave windings may find this new method of approach of great utility. In addition to the consideration of simplex windings of the lap and wave types, multiplex drum windings receive a fair share of attention and, in particular, the series-parallel type of winding is carefully considered.

A full exposition of the uses and correct application of equalising connectors to the types of winding to which they are applicable is also given, and the book concludes with a schedule of examples of windings actually employed by a number of well-known firms, with explanatory notes when necessary. We can cordially recommend the book to students, and also to electrical engineers who have occasion to go into the subject under consideration. It is clearly written by a man thoroughly conversant with his subject, which is presented in a compact and efficient form likely to appeal to all technical readers.

The second of these primers is written largely with a view to assisting amateurs who wish to construct small transformers to their own calculations. The first half of the book is concerned with explanations of transformer action in language suitable for men without any considerable technical knowledge. Vector diagrams are not used, and anything but the simplest mathematics is avoided, but it gives a good and accurate idea of transformer working for the type of men for whom the book is written. Subjects included in this part of the work are voltage regulation, efficiency and losses, and an account of the magnetic and electrical circuits of transformers.

The second part of the work is concerned with the design of small transformers (particularly up to 1 kW), the main point kept in view being to produce a transformer having given operating characteristics at a minimum cost. The calculations, though involving only simple mathematics, are perhaps likely to be somewhat laborious to the amateur, and we feel that this section of the work is likely to appeal more to men having greater technical knowledge. The method outlined is of great interest, the few assumptions made being of quite a minor character. An alternative method of calculation is also given in which reasonable assumptions as to the main dimensions are first made, followed by checks to see if the desired characteristics have been attained. The book may be well recommended to men who desire to construct a transformer for their own use, and many parts will be of considerable interest to men engaged in transformer design and construction as a profession.

In the third book we feel that the author has endeavoured to treat a very large subject in too small a space, with the result, despite the concise style adopted, that the clearness of the explanations suffers, and in some cases they are not readily followed. After an introductory chapter we find approximately one half of the book is devoted to an account of the general arrangements and mechanism of oil break switches. In these sections it is clear that the author is thoroughly at home, and he conveys a large amount of information in the minimum of space. At times he seems to fall into the error of imagining that his readers are as conversant with the general outline of the subject as he is himself, and those who are not will, as a result, have to follow the subject matter very closely, and possibly supply certain gaps from other sources. As an instance of this we may quote the consideration of fuse shunted overload trip coils where it is pointed out that the absence of fuse shunting may adversely affect the accuracy of the readings of the switch board instruments. Readers who are familiar with the usual arrangements will have no difficulty in appreciating this point, but others, of less experience, may, in the absence of further information, wonder why this effect is brought about. The latter portion of the book is devoted to the consideration of isolating switches, arrester gear, high pressure fuses, and methods of switch testing, and concludes with a short bibliography of the subject.

The book will be useful to those who have a general knowledge of the usual arrangements in high pressure switches and who wish to obtain additional information in the most concise form.

Armature Winding. A Practical Handbook for Students, Armature Winders, and Engineers in Charge. By C. SYLVESTER. Pp. xiii+171, figs. 129. London: Rentell and Co., Ltd. Price 7s. 6d. net.

There must be many winders wishing to advance their technical knowledge who find difficulty with standard text books owing to the limitation of their knowledge of first principles. There is thus a real need for books to bridge the gap between the usual text book and the ambitious winder's technical capacity. The intention of the author was to produce a book of this kind, for in the preface he promises that the winder who "will allow himself to be assisted by the advice contained in the following pages" will become "expert in every sense of the word."

One might deduce from the wording of the preface that the author has not had a conventional scientific training, but that he has mastered the technology of his subject by self-study, and is, therefore, qualified to teach others. A very careful and sympathetic study of the little book, however, serves only to reveal that the author does not really understand the essentials of the subject with which he deals, and his uninitiated readers are much more likely to be misled than helped. Incorrect statements and partial truths are rife throughout the book. A fair idea of the gross inaccuracies can be given by quoting an extract from Chapter 3, in which the author explains how a small generator is designed.

"A good formula for finding the electromotive force of a two-pole machine is:—

$$E = z\, n/10^8$$

that is where E=the electromotive force.

θ=the total number of lines of force cut by the armature conductors.

n=number of revolutions of the armature per minute.

10^8=number of lines of force which is necessary for one conductor to cut to produce one volt.

z=number of conductors on the face of the armature.

From the above formula it will be seen that the electromotive force depends upon, and is proportional to, the three values, 10^8, z, and n. If any one, or all three, are altered, the electromotive force will also be altered accordingly."

This senseless statement is followed by:—

$$\frac{E \times 10^8}{z \times n} = \theta \frac{110 \times 10{,}000{,}000}{1{,}152 \times 35} = 272{,}000.$$

On this page alone (p. 37) there are no fewer than seven blatant errors, and some of them cannot fail to have a decidedly harmful influence in misleading uninformed readers anxious to learn. On page 157 is the following amazing arithmetic for showing the student how to calculate the total resistance of two 30 ohm resistances in parallel:—

$$\frac{30}{1} + \frac{30}{1} = \frac{1}{30} + \frac{1}{30} = \frac{2}{30} = \frac{30}{2} = 15 \text{ ohms.}$$

Errors in simple arithmetic are very numerous, and in some cases must confuse the raw mind. For example, the author sets out to show how to design a dynamo for an output of 500 watts, and the first step he takes is to prove, by his elastic arithmetic, that the output of a 500-watt generator is really 506 watts.

We turn in despair from these technical matters in the hope of finding some merit in the way the author deals with the practical side of his subject, but only again to be disappointed. The reader is solemnly told that all core plates are bent in the act of punching, and that a pair of rolls for straightening the plates is an essential piece of machinery. When describing a baking oven for a repair shop, the author says: "The oven should be preferably steam heated, with pipes sufficient to produce a temperature of about 150 deg. F. A small fan fitted in the side of the oven will draw air through these pipes and this temperature will be maintained." Drawing air through steam heating pipes can hardly add to the heating effect, and, no doubt, what the author has seen is a fan for ventilating the oven, and he has not understood its purpose. On page 73, the would-be designer is informed that cotton-covered wire for coils for machines having a voltage above 200 sometimes has six layers of cotton. A definition is given for wave and lap windings that no winder could understand, and to make the confusion complete, a clear illustration of a wave winding is called a lap winding, and what is really a lap winding is called a wave winding. On page 53 is given a description and illustration of a former for turbo-alternator field coils, both of which entirely fail to give any idea of how such a jig should be designed.

Altogether the errors are so numerous and so gross that it is not possible to come to any other conclusion than that the book is one that should never have been published.

Tidal Power. By A. M. A. Struben, O.B.E., A.M.I.C.E. Pp. xii+112; figs. 13. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

Mr. Struben's little book comes at a moment when there is a revival of interest in the subject, and it is unfortunate that it was written just before the particulars of the great Severn scheme were published. Still, in spite of the absence of any comments by the author on that project, the book is very useful as a *résumé* of our present knowledge of the economic use of power from the tides.

The author does not minimise the difficulties that confront tidal power development, of which the chief is the great difference in "range" between spring and neap tides, but is of opinion that our increasing experience of hydro-electric plants will prove of great service in the solution of the technical side of the problem. He discusses various tidal basin systems, and gives a series of diagrammatic sketches of such systems capable of developing (at 100 per cent. efficiency) from 113 to 1,032 kW per basin area of 100 acres. He does not give consideration to the proposal popularised by Mr. J. O. Boving to generate at two or more points where the tide-times do not coincide and supply power to a common network.

The chapter on "Financial Considerations" is necessarily rather indefinite, seeing the lack of precedent in the establishment of tidal power schemes and the great physical differences to be encountered in the bays and estuaries of the British Isles. Mr. Struben gives it as his opinion that "tidal power can compete on a footing of equality with steam power as regards cost per unit produced by existing undertakings, when the capital invested in the latter amounts to £50 per kW installed, even when the cost of tidal power stations reaches as high a figure as £137 per kW installed." It does not appear that the costs and losses of long-distance transmission have been considered when arriving at this figure, and working costs (exclusive of management) have been taken as .20d. per unit generated—an estimate which will probably need revision upward.

The two chapters on "Preparation of Projects" and "Research" are stimulating, and will appeal to all British engineers. The whole book serves as a timely reminder that the United Kingdom is a thickly populated and industrial country, with all parts comparatively close to the seashore, and with a greatly indented coast line—natural advantages for tidal power development which none of our great national rivals possess.—E. S. R.

LEGAL.

An Electrical Unemployment Insurance Case.

At Loughborough, last week, the Ministry of Labour prosecuted a switchboard operator employed by the Corporation for not providing an Unemployment Insurance book. According to the *Nottingham Express*, Mr. R. B. Leach, the manager of the electricity works, said that the defendant refused to have the book, and that they had stamped it up for him on the temporary cards specially provided. It was manual work. On the average his earnings amounted to more than £5 per week.

An inspector of the Ministry of Labour said defendant when seen by him emphatically refused to have a card, saying he did not want to have anything to do with it.

Mr. Heane submitted that the defendant was not a manual labourer within the meaning of the Act. He quoted a High Court decision, which ruled that dairy foremen and tailors' cutters were not manual labourers. He submitted that he had no case to answer, as the prosecution had not made out their case. Defendant was a responsible worker, in charge of thousands of pounds' worth of machinery.

The Bench unanimously agreed that the defendant was not a manual labourer, and they allowed costs.

Person & Cox, Ltd., *v.* Berry.

In the Mayor's and City of London Court, last week, before Judge Jackson, an action was brought by Person & Cox, Ltd. (in liquidation), by M. Morgan, its liquidator, 17, Eldon Street, E.C., against Mr. W. J. Berry, dry cell manufacturer, of Southwark Street, to recover £25 11s. 4d. for electric accessories supplied. Defendant's counsel asked for an adjournment, and said that the plaintiffs had signed a deed of arrangement.

Mr. Reginald G. Davis, plaintiffs' solicitor, opposed the adjournment, and said plaintiffs had never signed the deed of arrangement. They always refused. The debt was admitted. He had every sympathy with the defendant, who had sold his business to a gentleman who undertook to pay off his liabilities. He did not propose to enforce the judgment for a time, so that the defendant could recover the money from the purchasers of the business.

Judge Jackson thought that very fair, and judgment was given for the plaintiffs, execution being stayed for two months.

White *v.* Chambers & Fleming.

Before Mr. Justice Gordon, in the High Court of Ireland, Dublin, a convention was made a rule of Court in an action by Mr. James White, of North Frederick Street, in that city, against Messrs. F. W. Chambers and G. P. Fleming, La Scala Theatre, Dublin, for £150, balance due in respect of electrical work. The settlement provided for the payment of £44 odd lodged with the defence, and a further £35, the parties to abide their own costs.

Hurst Electric Plant, Ltd., *v.* Cavan Light & Power Co.

In this case, which was reported here last week, his Lordship has given judgment against defendants for £130 and costs for breach of contract, remarking that plaintiffs could realise on the switchboard, which was in their possession.

Housing Schemes and Electric Light Accounts.

At the Liverpool Police Court, recently, thirty or more tenants of Corporation hutments at Knotty Ash were summoned for non-payment of their electric light accounts. Many of them said they had refused to pay because they were under the impression that the rent of from 16s. to 20s. per week included the cost of lighting. "It was understood when they charged such high rents," said one, "that light would be included." It was pointed out, however, there was no ground for this assumption, and the Bench made orders for the payment of the accounts.—*Liverpool Post.*

Rio Tinto Co., Ltd., *v.* A. G. Brown, Boveri & Cie.

In the Commercial Court of the King's Bench Division on July 5th, this case came on for hearing. It is an action for damages for alleged breach of contract relating to the construction of an electric railway in Spain by the defendants for the plaintiffs.

Sir John Simon opened the case for the plaintiffs.

On July 6th, it was intimated that the parties had arrived at a settlement, but as the defendants were a Swiss company, it was agreed that the case should stand over until Friday so that they might get confirmation from Baden. We shall report the matter next week.

BUSINESS NOTES.

Bankruptcy Proceedings.—K. H. Kerr & Co., makers of electrical accessories, Barrhill Works, Dalbeattie, Scotland.—A meeting of creditors was called for July 5th (the firm having been obliged to suspend payment), to consider the state of affairs and such proposal for settlement as might be made by the debtors. With the approval of creditors largely interested, Messrs. W. and W. B. Galbraith, of Glasgow, had been instructed to investigate the debtors' affairs, and prepare a statement.

William Wheatcroft, 162, Freeman Street, Great Grimsby, labourer, previously electrician. The following are creditors:—

Colbrook, W., ...	£400	Arrots Elec. Mfr. Co. (Louth)	£24
Kirkland	41	Tyson, H., ...	21
Dring, H. Saltfleetby	50	Swany, Thos., ...	20
Allen, F. W., ...	38	Cross, G., ...	19
Beadle, T., & Co., Ltd.	30	Chapman, Dr., ...	16
Gibbons	25	Cleveleys Advertising Co. ..	10

C. A. Carpenter, electrical engineer, 4-5, Mason's Avenue, Basinghall Street, E.C.—Receiving order made June 27th on creditor's petition. First meeting, July 11th; public examination, September 13th; both at Carey Street, W.C.

J. H. Toms, electrical engineer, 13, Gray's Inn Road, W.C.—Receiving order made June 27th on debtor's own petition. First meeting, July 11th; public examination, September 27th; both at Carey Street, W.C.

G. H. Gee, electrician, 10, Front Street, Annfield, Durham.—Receiving order made June 24th on creditors' petition. First meeting, July 12th; public examination, July 28th; both at Newcastle-on-Tyne.

E. Cloney, tramway divisional traffic superintendent.—Fourth and final dividend of 5s. 6d. in the £, payable July 8th, at Carey Street, W.C.

J. W. Layton, electrician, 5, Nobles Bank, Hendon.—First and final dividend of 1s. 4¾d. in the £, payable July 7th, at the Official Receiver's Offices, Sunderland.

R. C. Jones (Elect-Ma Engineering Co.), 10, Caledonia Street, King's Cross, W.C. Adjourned public examination, July 29th, at Carey Street, W.C.

A. Rowlands, electrical engineer, 45, Thrumpton Lane, East Retford, Notts.—Last day for proofs for dividend, July 20th. Trustee, Mr. F. C. Brogden, Official Receiver, 10, Bank Street, Lincoln.

W. Hedgecox, electrical engineer, 121, Salop Street, Wolverhampton.—Last day for proofs for dividend, July 22nd. Trustee, Mr. S. W. Page, Official Receiver's Office, 30, Lechfield Street, Wolverhampton.

Company Liquidations.—Anglo-Norwegian Electro-Chemical and Finance Co., Ltd.—Winding up voluntarily.

United Electric Car Co., Ltd.—Winding up voluntarily. Liquidator, Mr. G. R. Freeman, 66, Coleman Street, E.C. A meeting of creditors was called for July 7th. Particulars of claims must be sent to the liquidator by August 31st.

ENGINEERING AND ARC LAMPS, LTD.—A meeting of members is called for August 4th, at 29, Gracechurch Street, E.C., to hear an account of the winding-up from the liquidator, Mr. W. A. Henderson.

PORTABLE ELECTRIC MOTORS (1919), LTD.—First meeting of creditors and contributories, July 12th, at Carey Street, W.C.

E.B.C. ELECTRICAL CO., LTD.—A petition for the winding-up has been presented to the High Court by Mr. L. C. Harvey, consulting engineer, of 25, Victoria Street, S.W., and will be heard in London on July 19th.

Dissolutions of Partnership.—ADAM & GAYLER, electricians, Dyneto Works, Suffolk Place, Birmingham.—Mr. F. J. Adam and Mr. W. E. Gayler have dissolved partnership. Mr. F. J. Adam will attend to debts and continue the business.

ELECTRICAL EQUIPMENT AND INSTALLATION CO., electrical engineers, 64, Finsbury Pavement, E.C.—Mr. J. P. Castle and Mr. C. J. Arnold have dissolved partnership. Messrs. Castle & Co., solicitors, 31, Gracechurch Street, E.C., will attend to debts.

Trade Announcements.—The firm of A. V. WILLMOTT, 124-127, Minories, London, E. 1, has been re-constituted, and will be known as A. V. Willmott, Son, & Phillips, Messrs. R. O. Willmott and Mr. F. S. C. Phillips having joined the firm, which will specialise at the same address in insulating materials, traction and transmission material, &c.

MESSRS. LESLIE DIXON & CO., 91, Queen Victoria Street, London, E.C. 4, are now the representatives in the South of England for Messrs. John Fletcher, Ltd., electrical slate manufacturers, whose works are at Carnarvon.

MR. DAVID G. BROOKS, representing the Walsall Hardware Manufacturing Co., Ltd., has moved from 79, Lincoln's Inn, Corporation Street, to Daimler House, Paradise Street, Birmingham.

Messrs. Bruce Peebles & Co, Ltd., have recently appointed MESSRS. CHARLESWORTH, PEEBLES & CO., of 134, St. Vincent Street, Glasgow, as their agents for the whole of Scotland, with the exception of the area in the East of Scotland which, as for many years past, will still be covered by MESSRS. MITCHELL, GRAHAM & SON, LTD., 56, Buccleuch Street, Edinburgh. MR. J. A. HOOD still remains the Bruce Peebles Scottish representative.

Catalogues and Lists.—MR. C. GORDON SMITH, Royal London Buildings, Lichfield Street, Wolverhampton.—An illustrated and priced leaflet dealing with a patent "Economy" flood lamp for stage lighting, &c.

MESSRS. E. G. APPLEBY & CO., LTD., 70, Victoria Street, Westminster, S.W. 1.—A series of leaflets in volume form illustrating and describing "Phœnix" electro-magnets for various purposes, such as scrap handling, steel rail conveying, lifting castings, &c. The leaflets include a description of a 5-ton crane adapted for use with a magnet.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—"Monthly Magazine," July, 1921, containing stock and price-lists of motors and dynamos, notes on starting gear, and anecdotes.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C. 2.—List U L 1, "Industrial Lighting Boxes," giving full details, illustrations, and prices of small joint boxes for use in the lighting of collieries, shipyards, factories, warehouses, &c.

MESSRS. SCHOLEY & CO., LTD., 56, Victoria Street, Westminster, S.W. 1.—A folder advertising the "Croydon Premier" suction cleaner, giving several views of the works of the Electric Suction Cleaner Co.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—"Installation News," New Series, No. 7, July, 1921, containing notes on "Earthing of Factory and Works Installations," and descriptions of the "Simplex" hand-lamp and colliery-lighting system and "Stellite" lanterns for industrial and street lighting.

MESSRS. GEORGE ELLISON, Perry Bar, Birmingham.—List No. 17, illustrating and describing "Mill"-type free-handle air-break circuit breakers; and List No. 19, dealing with trailing cable sockets and plugs for air-break gate-end boxes, giving illustrations and dimensions. Both lists are fully priced.

KEIGHLEY GAS AND OIL ENGINE CO., Imperial Works, Keighley. — An illustrated blotter advertising "Imperial (Keighley)" gas, oil, and spirit engines.

MESSRS. HASLAM & STRETTON, LTD., 11, Windsor Place, Cardiff.—A descriptive circular of the approved "Thor" miners' safety lamp. Illustrated.

THE EXCELSIOR SHADE MANUFACTURING CO., Betterway House, Stamford Street, Nottingham.—A well-illustrated catalogue of "Betterway" lamp shades and fittings in various metal finishes. Also two of a series of office mottoes.

MESSRS. C. A. PARSONS & CO., LTD., Heaton Works, Newcastle-on-Tyne.—Pamphlet No. 3, illustrating and describing the application of steam turbines to paper mills. This shows the advantages of the turbine or turbo-electric drive for mill machinery, as well as the auxiliary advantage of the turbines in the provision of the steam necessary in certain processes.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C. 1.—Monthly stock list, No. 10, July, 1921, giving particulars of d.c. motors, new and second-hand.

THE ANGLO-SWEDISH ELECTRIC WELDING CO., LTD., Wood Wharf, Greenwich, S.E. 10.—A profusely-illustrated publication (35 pp.), describing the Kjellberg arc welding process and its applications.

MESSRS. F. J. SHENTON & CO., LTD., 68 and 69, Shoe Lane, E.C. 4.—A leaflet illustrating "Supreme" standard accumulators and burglar alarms. Fully priced.

MESSRS. BRUNTONS, Musselburgh, Scotland.—A well-illustrated catalogue of cold rolled-steel strip of many sizes; the list gives full instructions for ordering, and tables of decimal and metric equivalents, &c.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., Sunic House, Parker Street, Kingsway, W.C. 2.—Bulletins Nos. 35s and 36s dealing respectively with "Sunic" automatic X-ray combination, couches and screening stands, and a portable transformer unit (both illustrated and priced); Folder No. 38s, giving sizes and prices of back and front intensifier screens; and "Sunic Record," No. 14, giving the preliminary report of the X-Ray and Radium Protection Committee.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C. 2.—Pamphlet E. 2,351, giving an illustrated description, with prices, of studio arc lamps.

MESSRS. SAMUEL JACKSON & CO., 53, Briggate, Shipley, Yorks.—An illustrated and priced leaflet advertising the "Empira" electric washing machine.

Catalogues Wanted.—MR. R. A. JONES, who has recently taken over control of Messrs. Bass & Co., 402, Essex Road, wishes to receive catalogues.

Inquiries.—Makers of the "Manchester" oil engine, and of the "Lombard" 5-A intermediate corridor switch, are asked for.

Book Notices.—"Thermionic Tubes in Radio Telegraphy and Telephony." By J. Scott-Taggart. Pp. xxiv + 424; 344 figs. London: The Wireless Press, Ltd. Price 25s. net.

"Kelly's Directory of Merchants, Manufacturers, and Shippers of the World for 1921." In two vols. Price 64s. net. London: Kelly's Directories, Ltd.

"The *Journal* of the South African Institution of Engineers." Vol. XIX, No. 11. June, 1921. The subject of the paper included in this issue is—"Factors Affecting Mining Efficiency." The Institution's comments on the Electricity Power Supply Bill and the Apprenticeship Bill are also given. Accompanying this number of the *Journal* is a complete list of members.

"Theory of Wave Transmission." By G. Constantinesco. Vol. I. Pp. iv. + 211; figs. 51. London: Proprietors of Patents Controlling Wave Transmission.—This is a treatise on the transmission of power by vibrations, by the inventor of the system; an alternative title is "Theory of Sonics," from which it will be gathered that the transmission of energy "by means of impressed periodic variations of pressure or tension producing longitudinal vibrations in solid, liquid, or gaseous columns," has attained the dignity of a new branch of engineering science—that which deals with all applications of elastic properties of liquids for the transmission of power as distinct from "Hydraulics," which deals with liquids treated as being incompressible. The author first explains the production of impulses, their propagation along a column of matter, and their application to the performance of work at a remote point, after which he develops the theory of the subject, which naturally bears a close resemblance to that of alternating electric currents; terms such as "sonomotive pressure," "sonic current," capacities and condensers, &c., as well as power factor, and wattless components, not only heighten the similarity, but represent analogous quantities. Further on, when we come to the description of the actual apparatus employed, we meet with rotors and stators, synchronous and asynchronous three-phase motors, collectors, and so on, while later sections deal with "high-frequency currents," "charged lines," "transformers," &c. In the appendix numerous tables of constants and mathematical functions employed in the calculations are given. While it is not within our sphere to discuss in detail a work on "Sonics," we are interested in observing that a new science has thus been created and developed to so advanced a degree by the efforts of a single man, and we congratulate Mr. Constantinesco on the result of his labours.

"The M. and C. Apprentices' Magazine." Vol. V, No. 18. Summer, 1921. (54 pp.).—This number contains a talk on wages, &c., by Mr. Sam Mavor, and many other interesting articles and notes.

"Memorandum on Electric Arc Welding." Form 329 of the Factory Department, Home Office. (10 pp.) London: H.M. Stationery Office. Price 3d. net.

Punch Summer Number (1s.) celebrates Mr. Punch's eightieth birthday. In addition to other features, which are up to the usual standard, the number contains a section in colour depicting in contrast many interesting changes that have been witnessed during the period.

E.P.D.—The Federation of British Industries, last week, addressed a communication to the Chancellor of the Exchequer urging upon his sympathetic consideration two clauses dealing with the question of forward contracts and bad debts, which will be moved upon the report stage of the present Finance Bill. The object of both clauses is similar—viz., to secure that all firms should be placed as nearly as possible upon an equal footing as regards the burdens to be borne and the relief to be obtained under the provisions for the termination of E.P.D.

Lantern Slides.—MESSRS. BRUCE PEEBLES & CO., LTD., of Edinburgh, have prepared a very complete set of nearly 80 lantern slides showing their works and manufactures, and these are available for illustrating lectures on electrical machinery. In addition to views of their works, there are others dealing with generators and motors, motor generators, rotary converters, frequency changers, and the Peebles-la-Cour motor converter.

Copper and Lead Prices.—MESSRS. F. SMITH & CO. report, July 5th:—"Copper (electrolytic) bars, £77 10s., 30s. increase; do. sheets, no change; do. wire rods, £93 10s., 30s. increase; do. h.c. wire, 11½d., ½d. increase; silicium bronze wire, 1s. 3½d., ½d. decrease."

MESSRS. JAMES & SHAKESPEARE report, July 6th:—"Copper bars (best selected), sheet and rod, and English pig lead, no change in last week's quotations."

Fire.—Messrs. Albert Lee & Co., Ltd., ask us to state that the fire which occurred at their works at Andrews Road, Hackney, was not of a serious nature, and it in no way interfered with the business. They are still able to execute orders for glassware of all types from stock.

Electrical Measuring Instruments.—The publication of a special article in the *Westminster Gazette* of May 18th, dealing with some of the possible effects of the then proposed Safeguarding of Industries Bill on certain electrical products, in particular measuring instruments of precision, has been followed by a letter from Mr. D. N. Dunlop, on behalf of the B.E.A.M.A., dated June 23rd, and appearing in the *Gazette* for July 1st. Mr. Dunlop writes as follows:—"The article laid it down as practically indisputable that an American instrument, the 'Weston,' is so essentially different from, and superior to, any English instrument of the same kind, that it 'must' be regarded by manufacturers in this country as a 'basic tool.' I am to say that while the Weston instrument is admittedly excellent of its kind, it is not in any sense unique, and that there are a number of English makers of electrical instruments (whose names are available) capable of producing, and now producing in amply sufficient numbers, instruments performing precisely the same functions, and with quite as high a degree of accuracy. With regard to the statement that Mr. Enthoven, of the late Import Restrictions Department, gave special permits for the importation of 'some tons' of Weston instruments, thus indicating their indispensability, the writer of the article appears to be misinformed. Licences to import were issued during the war not because equivalent instruments were not made in this country, but because English makers were then engaged on other products considered by the authorities to be of greater immediate importance for war purposes, and ammeters and voltmeters of the Weston class were, therefore, not available in sufficient numbers."

U.S. Electrical Exports.—The Department of Commerce reports that exports of electrical goods from the United States in April were valued at $9,085,598, or about $2,000,000 more than the total in April, 1920. So far this year the exports are averaging nearly $12,000,000 a month, which, if continued, would make a record year. The total for 1920 was $102,618,508.—*Reuter's Trade Service* (Washington, June 14th).

Engineering Wages.—As briefly mentioned in our last issue, a provisional agreement between the parties to the engineering wages dispute was reached on June 30th, in time to avert a cessation of work. The terms of the agreement, which is being voted upon by the employés, are as follows:—The wage reductions are to be effected in three stages. The first reduction will take effect upon July 15th, and will consist of 3s. off weekly wages, and 7½ per cent. off time rates. A similar reduction will be made as from August 15th. The third stage, which concerns the "Churchill" munitions bonus of 12½ per cent. on time rates, and 7½ per cent. on piece rates, is to be the subject of negotiation in September. The proposals were adopted by the Trade Union delegates with but few dissentients, and the prospect of acceptance by the workers concerned is regarded with optimism, as the leaders recommend this course.

In announcing the arrival at the above agreement in the House of Commons on June 30th, Dr. Macnamara (Minister of Labour) paid a tribute to both sides, and said:—"The successful issue of the negotiations is a signal illustration of what can be done when employers' and workpeople's leaders sit down together to face a problem with a real intention of grappling with it until a solution has been found."

Private Meeting.—Albert Harry Osborn, electrical engineer, 67, Southgate Street, and 101, Welford Road, Leicester.—The creditors interested herein were called together recently at the offices of Messrs. Aspell & Barnes, Leicester, when a statement of affairs was presented which showed liabilities of £587, all of which were due to trade creditors. The assets were estimated to realise £290, from which had to be deducted £5 for preferential claims, leaving net assets of £285, or a deficiency of £302. It was reported that the values placed on the assets were those of the debtor. A full set of books had not been kept, and the only explanation of the deficiency was bad debts to the extent of £125, and loss made on contracts. The drawings had only averaged £3 a week. The debtor had been in business for some six or seven years. Recently creditors had been pressing, and in order to protect the estate, a deed of assignment had been executed, the trustee being Mr. R. Dunn, chartered accountant, of Messrs. Aspell & Barnes, 3, Welford Road, Leicester. An offer was made of a cash composition of 5s. in the £, but after discussing the position, it was decided that the estate should be dealt with under the deed already executed.

New Manufacturing Plants in India.—The directors of the Tata Co. are negotiating for the establishment of plants for the manufacture of railway wagons and locomotives, agricultural implements, wire products, tin plates, enamelled wire cables, and special steels for reinforcements. It is expected that these and other plants will ultimately be established at Jamshedpur.—*Reuter's Trade Service*, Bombay, June 10th.

China.—Tramways for Peking.—The Peking municipal authorities concluded a loan with the Banque Industrielle de Chine on May 9th for the construction of tramways in the capital. The capital of the tramway company will be $4,000,000, half of which will be raised by public subscription. Work will start when the money is raised.

Belgian Rail Contract.—*The Times* Brussels correspondent states that a Belgian firm of Marchienne has secured the contract for 95,000 tons of rails offered by the Argentine Government. The Belgian tender worked out at 469 fr. (about £10) a ton, as against the lowest French tender of 528 fr. (£11 10s.), a German tender of 2,550 M. (£9 11s.), an American tender of $61·65 (about £16 10s.), and a British tender of £14 10s.

Foreign Firms in China.—Foreign firms in China are increasing rapidly. The latest report shows the following:—

U.S.A.	413 firms	6,660	personnel.
Belgium	20 "	391	"
Denmark	27 "	546	"
Austria	5 "	27	"
Great Britain	644 "	13,234	"
Netherlands	25 "	367	"
France	171 "	4,409	"
Germany	2 "	1,235	"
Italy	19 "	367	"
Japan	4,878 "	171,485	"
Norway	12 "	249	"
Portugal	93 "	2,390	"
Russia	1,780 "	148,170	"
Spain	8 "	272	"
Switzerland	4 "	632	"
Others, unclassified	33 "	537	"

—*Journal* of the Office of the High Industrial Commissioner.

Annual Outings.—On Saturday, June 25th, the staff of Messrs. Aish & Co., electrical contractors, Bournemouth, went by motor-coach to Brighton. On the outward journey, Bognor, Littlehampton, and Worthing were visited; the return journey was made through Arundel and Chichester.

On Saturday last the employés of the Hackney Borough Council Electricity Department held their annual outing, proceeding to Southend by charabanc. A large party sat down to lunch at the Palace Hotel, Mr. L. L. Robinson, borough electrical engineer, being in the chair, supported by the Mayor of Southend, the Mayor of Hackney, Councillor B. A. Little, vice-chairman of the Electricity Committee; Mr. R. Birkett, electrical engineer at Southend; Mr. J. R. J. Bowden, deputy electrical engineer of Hackney; Mr. T. Dalby, power-house superintendent; Mr. J. F. Heathman, chief clerk, Electricity Department, who was responsible for the arrangements, and others. The chairman proposed the toast of "The Mayor and Corporation of Southend and the Southend Electricity Department," and expressed the pleasure of the company at the presence of Mr. Birkett. Responding to the toast, the Mayor of Southend recalled the fact that he was born in the Borough of Hackney, and had spent many happy years within its boundaries. He was very pleased to have them in the town, and trusted that they would have a very enjoyable time, and that this would not be the last time that the Hackney Electricity Department would make Southend the place of their annual outing. Mr. Birkett also responded, inviting those who so desired to inspect the electricity works and the boulevard tramway system. The Mayor of Hackney, in proposing the toast of "The Hackney Electricity Undertaking," paid a tribute to the ability of Mr. Robinson, and expressed his pleasure at his return to duty after a successful operation. The Mayor pleaded for cordial relations between the technical and operative staffs. Mr. Ingrey, the chairman of the Shop Stewards, responded on behalf of the employés. Mr. Heathman, chief clerk, Electricity Department, proposed the toast of "The Guests," which was responded to by Councillor W. Parker, J.P.

The staff and workmen of the Tunbridge Wells Corporation electricity department held their annual outing on the 29th ult., going by motor charabanc to Eastbourne, Pevensey, and Hastings. This was the first outing since 1914, and a party of 33 (including the borough electrical engineer) had a delightful drive through some of the most picturesque country in Sussex. Lunch was partaken of during a three hours' stay at Eastbourne. At Pevensey an inspection was made of the famous old Mint House and Castle ruins, followed by an excellent tea. The party then made for Hastings, where a halt of two hours was made prior to the run home.

The staff of the Electrical Supplies Co. held their outing on Saturday, June 25th. They went by charabanc to Marlow, where a very varied programme was provided, including numerous round games, ending up with a dance in the evening. Owing to the temperature, the more strenuous items were omitted, and the whole party spent a good time on the river. At the dinner the chairman gave a few very encouraging remarks to the staff, pointing out that the present slump could not continue for long, and they were quite prepared for the revival when it came.

For Sale.—By direction of the Disposal Board, Messrs. Douglas Young & Co. will sell by auction, at the National Filling Factory, on July 14th, the remaining plant and machinery, including motors, pumps, &c.

Newport Corporation has for disposal one 500-kW set consisting of a cross-compound reciprocating type engine (Markham & Co.), coupled to a 460/500-V d.c. generator.

Burnley Corporation electricity department invites offers for one 250-kW Belliss-Dick-Kerr generating set 440-550 V, complete with condensing plant, and one 30 ft. × 8 ft. Lancashire boiler, with Bennis stoker.

Messrs. Churchill & Sim will offer by auction at Hendon on July 12th and 13th, the stock of timber of the Aircraft Manufacturing Co., Ltd. (in voluntary liquidation). For particulars see our advertisement pages.

Russian Electrical Notes.—According to a Russian paper, a plan has been prepared for the electrification of the peat working machines, &c., of the Komaroff marshes, near the shore of the Gulf of Finland, in the Peterhoff district. It is proposed to raise the steam required with boilers that are going to be removed from certain ships. The electrotechnical section of the Government has prepared plans for the electrification of 13 villages in the Pelgorsk district of the Novgorod Government. Preparatory work has been begun for the construction of the temporary electrical station at Vologda, and the extension of the Novgorod station, whilst considerable progress has been made with the distribution schemes for various electrical stations in the country, and the central electricity works of Staroi Russ is being completed.

A message from Homel says that in Peninitze an electrical station has been constructed, and the chief streets of the town and the public institutions are now lighted by current from it. It is stated that work is about completed for starting the electrical plant at the Treugolnik factory; but fuel is assured for a month only, and the furnaces have been adapted to burn liquid fuel in the future.

It is reported, says an article in the *Isvestia*, that there has been a feverish activity in the installation of small electrical plants in the country.

Readers concerned with Russian affairs may be interested to learn that the Russian papers may be seen at a Reading Room at 116, Oxford Street, W. 1.

Electricians' Wages.—Notices have been posted in all affected works, reminding the electricians that, in accordance with the agreement made at York between the E.T.U. and N.F.E.A., the second wage reduction comes into effect on the first pay-day following July 9th. This makes a total reduction of 10 per cent. from the wages being paid prior to the agreement.

Profit-Sharing in Coal Mining.—The Executive of the Labour Co-partnership Association has issued the following:—"The Executive of this Association has had before it the official settlement of the coal crisis. There is one part of the settlement that specially interests this Association, and that is the adoption of the principle of co-partnership and profit-sharing for which it has worked for many years. The standard wage which has been set implies that profits shall be paid out of a fund secured by the united goodwill of the miners and mine owners, and that a large share of the surplus shall go to the workers themselves. Now that the first step has been taken, this Association looks forward hopefully to the development, as circumstances permit, of the complete co-partnership idea."

Unemployment.—The latest available returns of the Ministry of Labour show that the total number of unemployed registered at labour exchanges for the week ended June 24th was 2,178,000, an increase of 10,000 upon the preceding week's total. This was in addition to workers on short time, who numbered 953,290.

E.D.A. Activities.—"Selective Publicity for Installation Contractors and Electricity Supply Undertakings" (E.D.A. 166), recently issued by the British Electrical Development Association, may be described as a complete letter writer for the use of those named in the title. It comprises a set of twelve circular letters pointing out to the recipients the labour-saving properties, cleanliness, &c., of electrical methods in the home. Each is suitably illustrated, and the arrangement is such that a seasonable appeal is made month by month throughout the year. Hints as to the best way to prepare and dispatch these letters are given, and the cost per 1,000 is shown in detail.

The A. & G.E. at Derby.—At the R.A.S.E. Show at Derby, the King visited Stand 47 of AGRICULTURAL AND GENERAL ENGINEERS, LTD., and was received by Mr. J. G. Barford and Mr. G. M. Blackstone, directors, and Lieut.-Col. C. F. Hitchins, D.S.O., general manager of the company. The general manager informed His Majesty that the company was an association of 14 of the oldest and best known engineering firms in the country, employing in normal times some 18,000 workpeople, producing all types of engines, both steam and internal combustion, also every description of agricultural implements, &c. His Majesty expressed his pleasure at the initiative displayed by British manufacturers.

Electrical Goods in South Africa.—*South African Mining and Engineering* for June 4th, says that owing to the insufficiency of current and the inactivity in the building trade at present, business is rather slow in Johannesburg and along the Reef, and not so many orders are now coming in from other parts of the Union. There is no change to report in prices, but the tendency is for them to come down, as the latest quotations from Britain are coming in easier, tubing especially so. Material is arriving regularly from Britain, but none at all from the Continent, owing to the 26 per cent. Customs levy recently imposed, whose vagaries are not yet rightly understood on either side of the water. The recent reduction in freights will help to cheapen electrical goods later on. At present all lines are well stocked here.

German Competition in South Africa.—At the annual meeting of the Port Elizabeth Chamber of Commerce, the President said:—"Many of us have not handled German goods, but we must now seriously consider whether it is not futile to attempt to ignore the commercial activities of seventy millions of people. The Germans are at work again, and supply certain goods below American and British cost. The up-country man considers price, and if we decline to handle German goods it is useless to import British or American goods to sell at a loss."—*Reuter.*

LIGHTING AND POWER NOTES.

Belfast.—PRICE INCREASE.—At the monthly meeting of the Corporation on the 1st inst., a recommendation was put forward by the Electricity Committee, fixing the tariff for electric light and power at 30 per cent. above the existing rate, as from July 1st.

Bexley.—INCREASED PRICE FOR BULK SUPPLY.—The Urban District Council has asked the Foots Cray Electricity Supply Co. to agree to accept for bulk supply of electricity, the amended terms of 2·305d. per kWh against ·94d. now paid. The Council is advised that the company could obtain a bulk supply from the Woolwich Borough Council if the agreement with Bexley were revoked.

Birkenhead.—BULK SUPPLY.—An arrangement has been come to between the Electricity Committees of Birkenhead and Wallasey, subject to the approval of both Town Councils, for the supply of electricity in bulk by Wallasey to Birkenhead, with a minimum annual payment of £3,500. The Birkenhead Town Council, at its monthly meeting on July 6th, was asked to accept a tender for the laying of cables from the Marshall Street substation, Birkenhead, to the Wallasey generating station at a cost of £9,241.

Birmingham.—EXTENSIONS.—The Finance Committee has approved the application of the Electric Supply Committee for the sum of £395,000 to cover a part of the extension scheme spread over a period until 1925.

RESTRICTIONS RELAXED.—The Emergency Committee of the City Council had under consideration last week the question of the emergency restrictions in the light of the altered conditions (the return of miners to pits in the Midlands). The Committee came to the conclusion that a relaxation of the restrictions could be made so far as they affected the lighting and small power users, and recommended that these be immediately removed. When, at a later date, supplies of coal of good quality were forthcoming, the restrictions on tramway services and large power consumers would also be relaxed. This immediate relief for the electricity users is greatly appreciated, and the effect has been that many factories have resumed almost normal working.

Blackburn.—YEAR'S WORKING.—The total revenue of the Corporation electricity department for the year ended March 31st last was £110,165, as compared with £91,321 in the preceding year. Working expenses amounted to £91,949, as against £70,744, leaving a gross balance of £18,216 (£20,577). This balance was absorbed by capital charges, and the net result was a deficit of £2,321, comparing unfavourably with a net loss of £345 on the previous year's working.

Blackpool.—SUSPENSION OF METER RENTS.—The Corporation Electricity Committee has decided to suspend the operation of meter rentals for the June quarter, in consequence of the restrictions on supply.

Chatham.—PRICE INCREASE.—The Kent Electric Power Co. has increased the price of electricity for lighting by 1d. per unit, and for power and heating by ½d. per unit.

Chesterfield.—LOANS.—The Town Council has applied for loans of £1,000 for service cables, £1,000 for distributors, £2,000 for e.h.p. cables, and £750 for the covering-in of the river at the electricity works.

Continental.—FRANCE.—It was reported, last week, that the electricity works at Dieppe had been destroyed by fire, depriving the town of light and power. The damage is estimated at 2,000,000 fr.

DENMARK.—The Technical Commission appointed by the Home Ministry is exploring the possibility of utilising sea currents for the production of electrical power. A systematic investigation has been instituted of the currents in the Little Belt, which are known to be strong at times, but which have not yet been accurately measured, in order to determine whether they would yield sufficient constant power to render exploitation profitable.—*Reuter's Trade Service* (Copenhagen).

GERMANY.—The nationalisation of the electrical industry in Germany began, according to an article in the *Elektrotechnische Zeitschrift*, in December, 1919. The law of that year permitted the State by way of compensation, to appropriate every undertaking generating electricity exceeding 50,000 V or 5,000 kW. By this means the State became the owner of all the high-pressure lines which were capable of being interlinked and worked by the State and the local companies. Among the new schemes complementary thereto, mention may be made of the canalisation of the River Neckar from Mannheim to Plochingen. Up to the present, funds have been lacking for this, although Dr. Bosch, of Stuttgart, offered to contribute 13,000,000 marks. In a distance of 200 km., the Neckar falls 160 metres between Plochingen and the Rhine; 34 sluices would suffice, with falls ranging from 2·6 to 8·5 metres, permitting the passage of ships of 1,200 tons burden. It is reckoned that 300,000,000 kWh could be generated yearly, allowing for all losses. The details of the scheme for the linking of the Rhine with the Danube by a canal are complicated, and construction at certain points would be difficult. The canal would use the winding part of the Main River, and would pass through Wurtzburg, Nürnberg, Aschaffenburg, &c. This scheme would have a yearly output of between 700,000,000 and 1,000,000,000 kWh. There is also a scheme for the building of a canal on the Rhine

between Basle and Strassburg. It is reckoned that 1,800,000 kWh could be obtained yearly from the falls below Basle, and 1,200,000,000 kWh from the falls above that city. In the North of Germany there is a question of linking the Weser with the Fulda, and it is proposed to replace the existing sluices by larger ones. It is believed that 70,000,000 kWh yearly could be obtained, which would be enough to cover the outlay. There is likewise the Oder River project (100,000,000 kWh), that of the Weser, and lastly, the Masurian Canal, which would furnish electricity to East Prussia (20,000,000 kWh).—*L'Electricien.*

Cookham.—Provisional Order.—Application has been made to the Electricity Commissioners by Lord Weston, Sir Geo. Young, Bart., and others, for authority to generate and distribute electricity for public and private purposes in the villages of Cookham and Cookham Dean.

Coventry.—Year's Working.—The results of the working of the city electricity-department for the year ended March 31st were as follows:—Total revenue, £226,145, as compared with £192,488 in the previous year; working expenses, £168,501, as against £134,748; gross profit, £57,644, as against £57,740; capital charges, £52,434 (£47,685); net profit, £5,209 (£10,055). The greater part of this profit is to be utilised for works expenditure and for new plant; only a balance of £31 is to be carried forward.

Electricity District.—N.E. Midlands.—The *Yorkshire Post* says that the Sheffield Corporation has lodged with the Electricity Commissioners a comprehensive scheme for the constitution of an electricity authority for the North-East Midlands area. The new authority will be composed of 18 members—12 appointed by the Sheffield and Rotherham Councils, and one each for the Chesterfield and Doncaster Councils, the West Riding, Derbyshire, Notts., and Lindsey County Councils. It is proposed to link up the big Sheffield power stations at Neepsend and Blackburn Meadows with the Rotherham generating station, and later, as required, further links will be made between Mexborough, Doncaster, Chesterfield, Chapeltown, and the intermediate districts. The district includes the big collieries of South Yorkshire.

The additional plant required under the scheme is proposed to be provided as follows:—Blackburn Meadows, 30,000 kW; Rotherham, 30,000 kW; the new stations at Doncaster and Mexborough, 90,000 kW, increasing later to 120,000 kW. As the plant at the following stations becomes obsolete, it will be discarded, provided an alternative and cheaper supply is available; the East Street and Kelham Island stations of the Sheffield Corporation, and the existing stations at Chesterfield, Doncaster, Worksop, and Mexborough, and the Rotherham No. 1 station.

Ellesmere Port.—Transfer of Order.—Having written to the Electricity Commissioners asking them the terms upon which they suggest that the Ellesmere Port Electric Lighting Order should be transferred to the Mersey Power Co., the Council has now received from the Commissioners a draft deed of transfer, which provides for the re-purchase of the undertaking by the Joint Electricity Authority on agreed terms in 1952-3, the date when the Runcorn and Widnes undertakings of the Mersey Power Co. are re-purchasable. The Commissioners added that in their opinion the best interests of the district would be served by the transfer of the order to the company. Some of the Commissioners had personally visited the Ellesmere Port district on the termination of the recent Liverpool Inquiry, and the district was one in which there were already established important industries, extensive in character, though few in number. The Council's consulting engineer agreed that the amount of electricity to be distributed in Ellesmere Port for public lighting or for domestic purposes would be small and insignificant compared with the amount required for industrial purposes, and the Commissioners pointed out that for the Council to establish a small and necessarily limited system of distribution for private and public lighting separate from the system which had been laid, and would have to be laid, for the supply to existing and future industrial works, would entail a duplication which would add unnecessarily to the capital expenditure, and would, therefore, increase the cost of electricity to the district. The clerk to the Council stated that the Commissioners had omitted the most important point from their reply—that was the matter of a bulk supply to the Council.

Folkestone.—Extension of Area of Supply.—The Folkestone Electricity Supply Co., Ltd., is applying to the Electricity Commissioners for a special order authorising the extension of the area of supply to include the Urban District of Cheriton and the parishes of Saltwood, Newington, and Hawkinge.

Gloucester.—Price Adjustment.—The Town Council has decided to increase the price of electricity by one-fortieth of a penny per unit for each shilling above 25s. per ton, which the Corporation has to pay for coal.

Heston and Isleworth.—Proposed New Station.—The *Evening Standard* states that the District Council, in conjunction with the borough of Ealing, has decided to submit to the Electricity Commissioners a scheme for establishing a new power station for the combined districts near the Duke of Northumberland's residence on the banks of the Thames. The total area of the district is about 9,000 acres. The assessments are nearly £1,000,000. The present generating stations are very inconveniently placed, and sanction for the extension of these stations could not be obtained from the Commissioners.

Houghton-le-Spring.—House Lighting.—The Rural District Council has approached the Houghton-le-Spring District Electric Lighting Co. with regard to a supply to the new houses on various local sites. The company has expressed its willingness to supply electricity provided that the Council guarantees a fair return upon the capital expenditure which will be incurred.

Japan.—New Power Companies.—A scheme is under way to establish the Abukumagawa Hydro-Electric Co., and the Tokio Electric Transmission Co. The first will have a capital of 10,000,000, and develop 55,000 kW by harnessing the Abukuma River, Fukushimaken, while the other company will have a capital of 30,000,000 yen, and supply this power to Tokio.—*Reuter's Trade Service* (Tokio).

Kingston-on-Thames.—Year's Working.—The accounts of the Corporation's electricity undertaking for the year ended March 31st last, show a total income of £43,254, as against £36,705 in the previous year. Working expenses totalled £31,199, as against £24,003, leaving a gross balance of £12,055 (£12,702). After the payment of capital charges, the net result was a profit of £697, a considerable decrease upon last year's profit of £2,256. The total number of kWh sold increased from 1,848,038 to 1,928,476.

Manchester.—Year's Working.—The annual report upon the City electricity undertaking for the year ended March 31st, 1921, has recently been published. The total revenue from all sources amounted to £1,547,226, as against £1,197,199 in the preceding year. Working expenses totalled £1,115,239, as compared with £765,357. The gross surplus was, therefore, practically the same as in the year 1919-20, amounting to £431,987, as against £431,842. Capital charges were, however, heavier, reducing the net profit of the undertaking from £87,634 to £69,123. Of this balance, £37,230 was appropriated in aid of the city rates, while the remainder was transferred to reserve. The number of kWh sold rose from 182,419,070 to 199,618,813. The total expenditure on capital account during the year was £426,273, and additional borrowing powers to the extent of £1,750,277 were obtained. Of this last amount, £1,392,000 was in respect of the new Barton station and high-pressure mains. In the course of the year many contracts were placed for the supply of equipment for the Barton station, including e.h.p. and l.p. switchgear, transformers, steelwork, circulating-water pumps, and water-screening plant. One 2,000-kW motor-generator was placed in the Dickinson Street substation, and one 1,500-kW motor-converter. Orders were placed with Messrs. Bruce Peebles & Co., Ltd., for eight motor-converters for installation in distributing stations. Mains were extended by a length of over 13 miles, and contracts were allotted for the supply of 33,000-V cables in connection with the first section of the Barton station.

Preston.—Proposed Purchase.—The Corporation is applying to the Electricity Commissioners for authority to generate and supply electricity for public and private purposes, and to purchase the undertaking of the National Electric Supply Co., Ltd.

Sunderland.—Year's Working.—The annual report of the Corporation electricity department for the past financial year shows a total revenue from all sources of £170,668, as compared with £137,240 in the previous year. The working expenditure was £121,913, as against £90,718, leaving a gross balance of £48,755 (£46,522). This balance was applied as follows:—Interest on capital, £13,504; income-tax, £1,778; repayment of loans, £21,258; cost of boilers, &c., £1,940; battery vehicles, £4,295; and depreciation of stock, £465, the balance of £5,485 being carried forward to the present account. The total number of units sold was 21,150,197, an increase of 9 per cent. upon the previous year's sales. The cost per unit rose from 1·54d. to 1·79d.

The department has been able to maintain a good supply of electricity during the whole period of the coal trade dispute. Restrictions had to be imposed on consumers for a time, but for the last month of the strike a full supply was maintained. The main source of coal supply has been an old copperas bank near the riverside a few miles away, and from this heap some thousands of tons of small coal have been obtained. The heap has lasted only just long enough for the purpose. The two largest of the 12 boilers have been kept going by means of oil-burning plant which was temporarily installed.

Taunton.—Extension of Supply Approved.—The Rural District Council has given conditional consent to the application of the Town Council to supply electricity to the Parishes of Bishop's Lydeard, Norton Fitzwarren, and Staplegrove.

Walsall.—Year's Working.—The report upon the Corporation electricity undertaking for the year ended March 31st, 1921, records a total income of £96,061, as against £78,251, in the previous year. Working expenses totalled £74,378, as compared with £47,860, leaving a gross balance of £21,683 (£30,391). Loan interest, debt redemption and other capital charges absorbed £20,069, making the net result a profit of £1,614, a considerable decrease on the figure for the previous year—£10,524. The total number of kWh sold rose from 7,419,265 to 8,397,868. While the cost per kWh sold, including capital charges, increased from 2·19d. to 2·70d., the price obtained only rose from 2·53 to 2·74d.

Weybridge.—Price Increase Refused.—It is stated that the Electricity Commissioners have declined to sanction an increase in the maximum price of electricity from 10d. to 1s. per kWh at Walton-on-Thames and Weybridge.

Wolverhampton.—ELECTRICITY SCHEME RECOMMENDED.—The Electric Supply Committee has recommended the Council to accept the Electricity Commissioners' scheme for the re-organisation of the various Midland electrical undertakings. For some time the attitude of the Wolverhampton authority had been a little doubtful, and a decision to stand apart might have decisively influenced the fate of the scheme. The proposed reorganisation will embrace Wolverhampton, West Bromwich, Stoke-on-Trent, Ironbridge, Rugeley, and Cannock. This development is of considerable importance to industry in South Staffordshire and the Black Country.

TRAMWAY AND RAILWAY NOTES.

Birkenhead.—REVISED FARES.—The Tramways Committee has prepared a scheme for the revision of fares and stages to come into operation on August 1st. In some instances it is proposed to curtail the stages, whilst in others the fare for the whole route is to be increased.

Birmingham.—RAILLESS CARS.—The Tramways Committee recommends the institution of a railless car service on the Nechells route as an alternative to track reconstruction. Although 12 new cars, costing £3,000 each, will be required, the Committee considers that a considerable saving will be effected by the adoption of this system.

Blackburn.—YEAR'S WORKING.—The report upon the Corporation tramways for the year ended March 31st, 1921, records a total income of £137,758, as compared with £119,958. Working expenses amounted to £119,840, as against £91,911, leaving a gross trading balance of £17,918 (£28,047). After payment of capital charges, the net result was a profit of £751, compared with £413 for the preceding year. Receipts per car-mile increased from 22·52d. to 26·12d., and the number of passengers carried from 17,902,546 to 18,260,154.

Brighton.—SHORT-TERM LOAN.—In order to cover a deficit in the tramway accounts for the year ended March 31st last, stated to be due to exceptionally heavy track renewals charged against revenue, the Tramways Committee is seeking to raise money by means of a short-term loan. The Finance Committee does not look with favour upon this course as the deficit is properly chargeable against local rates.

Colne.—LOAN.—The Town Council is making application to the Ministry of Transport for sanction to borrow £6,600 for the purchase of new tramcars.

Continental.—AUSTRIA.—The *Economic Review*, quoting the *Neue Freie Presse*, says that the loss of almost all her coal mines at the end of the war turned Austria's eyes to the question of the development of her water-power. Failing foreign credit, Austrian capital has supplied the means to begin the electrification of the railways, and in some measure to make good the deficiencies of the coal supply. The yearly coal requirement of the State railways is about 3,000,000 tons, to produce an output of 116,000 h.p. Of the total 3,400 km. of railway, 650 km. on the Arlberg and Tanern lines will first be electrified, with a demand of about 25,000 h.p., or, if the Salzkammergut line be included, 40,000 h.p. that is, about a third of the output of the yearly coal consumption. The power stations on the Spuller Lake and the River Ruetz are nearing completion, and the unemployed are building the Mallnitz and Stub River stations. At Arlberg, on the Innsbruck-Bregenz line, the installation of the lines is now in progress, electric locomotives, heavy and light, for passenger and goods traffic are in preparation, and special accumulator-trucks are to serve side-lines. All the important apparatus is the product of Austrian factories.

PORTUGAL.—The tramway strike, which has been in operation for more than a month, came to an end to-day.—*Reuter* (Lisbon, July 3rd).

Japan.—HIGH-SPEED ELECTRIC RAILWAY.—Application has been made to the Government for a charter to construct a high-speed electric railway between Tokio and Nikko, a distance of 80 miles. Under this scheme it is proposed to cover the distance in two hours.—*Reuter's Trade Service* (Tokio).

London.—UNDERGROUND FARES.—On June 30th Mr. A. Neal, Parliamentary Secretary to the Ministry of Transport, replying to Mr. Leonard Lyle, who asked whether, in view of the decrease in the cost of labour owing to the fall in the Board of Trade index number, the public might anticipate in the near future some reduction in the heavy fares on the underground railways of London, and called attention to the increase in the value of the shares of the company operating these railways, said :—"My right hon. friend has not overlooked the powers of review conferred upon him by Sub-Sec. 3 of Sec. 6 of the London Electric Railway Companies (Fares, &c.) Act, 1920, and at the termination of the present half-year the companies will be called upon to submit statements of the financial results of working for examination. It is upon these figures, and not upon fluctuations in the market price of shares, that any adjustment of charges must be based."—*The Times.*

THE LEYTON TRAMWAYS.—The municipal tramway undertaking of Leyton was to be transferred to the L.C.C. as from July 1st.

Manchester.—YEAR'S WORKING.—The working of the Corporation tramways during the year ended March 31st, 1921, brought in a total revenue of £1,813,401, as compared with £1,586,863 in the preceding year. The working expenses amounted to £1,507,566, as against £1,207,231 in 1919-20, leaving a gross surplus of £305,835 (£379,632). Adding interest on investments, &c., the total was £316,147 (£398,495). Capital charges absorbed £191,718 (£170,658), leaving a balance of £124,429 (£227,837). From this, £18,263 was deducted for income-tax, and the balance (£106,165) transferred to the renewals fund. The number of passengers carried decreased from 285,046,914 in 1919-20 to 277,738,710 in the year under review. The car-mileage also decreased from 18,906,654 to 18,711,007, in spite of an increase of over four miles of track. The total mileage (single track) owned or leased or over which the Corporation exercises running powers is now over 208 miles.

EXTENSION OF SERVICE.—Following upon the municipalisation of the Denton and Audenshaw tramways, the Manchester Corporation has secured running powers over 2½ miles of the route. The Corporation intends to run a service straight through to Hyde, a distance of seven miles, when the track has been relaid.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—Considerable improvement has recently been effected in the transmission times of telegrams between this country and South Africa, but, unfortunately, increased general delay has again to be apprehended owing to the interruption of the Eastern Telegraph Co.'s cable between Aden and Zanzibar at a position where, at this time of the year, the S.W. Monsoon blows with great strength. It is feared that, owing to the weather, the restoration cannot be expected for some considerable time.—*Reuter's Trade Service.*

Mr. Pike Pease, replying to questions in Parliament, said that as soon as cable repair work in the Red Sea was completed (probably within the next week) it was hoped that the present exceptional delays in cable service to the Far East would cease.

The Telephone Service. — COMMITTEE'S INQUIRY.—The Select Committee on Telephones, of which Mr. Evelyn Cecil is chairman, hopes to conclude the taking of evidence before the end of the session. It intends afterwards to send its expert assessor, Mr. W. W. Cook, to report on the telephone systems of the United States, Canada, Sweden, Norway, and Denmark. The Committee is of opinion that the inquiry cannot be complete without an independent report of this character from an expert not connected with the Post Office, says *The Times.* A formal interim report may be made at the end of the session, but it will be necessary for the Committee to be re-appointed next year. The drafting of the final report will be proceeded with in the autumn, and it will be presented, it is probable, not long after the re-assembly of Parliament.

LOWER RECEIPTS.—The Post Office has issued the following explanation of the decrease of 1 million sterling in the telephone receipts for the quarter ended June 30th, shown in the Revenue Returns published on July 1st :—"The falling off in the telephone receipts paid over to the Exchequer in the quarter just ended, is due merely to the fact that under the new tariff subscribers pay their rental and call fees quarterly, and to some extent in arrear, whereas under the old tariff the rental was paid annually in advance, and call fees periodically in advance. The total shortage of cash revenue in the year of transition due to this change-over is estimated at £2,600,000. The change of system was introduced for the convenience of the public, and has all along been part of the scheme of the new tariff."—*The Times.*

Post Office Board. — The Postmaster-General has appointed a Post Office Board, consisting of the heads of the most important branches of Post Office work. The members are :—

Right Hon. F. G. Kellaway, M.P., Postmaster-General.
Right Hon. H. Pike Pease, M.P., Assistant Postmaster-General.
Sir Evelyn Murray, K.C.B., Secretary to the Post Office.
Mr. E. Raven, C.B., Second Secretary to the Post Office.
Sir Henry N. Bunbury, K.C.B., Comptroller and Accountant-General.

ASSISTANT SECRETARIES TO THE POST OFFICE.

Mr. W. G. Gates, C.B., Home Mails Branch.
Mr. F. J. Brown, C.B.E., Telegraph Branch.
Brig.-General F. H. Williamson, C.B.E., Foreign and Colonial Branch.
Mr. J. Y. Bell, Establishment Branch.
Mr. A. R. Kidner, Telephone Branch.
Mr. W. T. Leech, Staff Branch.
Mr. W. E. Parsons, Buildings and Supplies Branch.
Sir William Noble, Engineer-in-Chief.
Lieut.-Col. T. M. Banks, D.S.O., M.C., Secretary.

Wireless Telegraphy.—At the conference in London of the Prime Ministers of the Empire on July 5th, a committee was appointed, says the *Daily Mail*, to consider the practical means available at the present time for developing Imperial communications by land, sea, air, cable, and wireless telegraphy and telephony.

Post Office Advisory Council.—The Postmaster-General has appointed Lord Colwyn and Sir John Dewrance, K.B.E., to be vice-chairmen of the Post Office Advisory Council, says *The Times.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia. — MELBOURNE. — August 24th. Victorian Railways. Motor-generator set, accessories and switchgear (for automatic telephone exchange, Contract No. 34,132).*

August 31st. Victorian Railways. Accumulator cells and accessories, Contract No. 34,171 ; electric light equipment (axle generator system, Contract No. 34,172).*

October 19th. Victorian Railways. Fresh tenders are invited for the supply of an electric furnace for the Newport workshops. —*Reuter's Trade Service* (Melbourne).

SHIRE OF HAMPDEN (VICTORIA).—August 17th. Boiler-house plant, steam-driven electricity generators, transformers, meters, switchgear, cables, poles. Specifications from Mr. H. C. Ingleton, Shire Hall, Camperdown, Victoria.—*Tenders.*

BRISBANE.—July 18th. Queensland Water Supply Department. 54,000 yd. h.d. copper cables, various diameters, for overhead transmission ; 2,980 ft. lead-covered, armoured copper cables, various gauges, with accessories.*

TASMANIA.—August 15th. P.M.G.'s Department. Switchboard material. (See this issue.)

Belgium.—August 9th. Provincial Government authorities at Mons. Either a gas engine or electric motor, together with a pump, to raise from 150 to 200 cubic metres of water per hour from the Strepy waterworks to the Houdeng reservoirs.

Brandon and Byshottles.—Electric light installation, houses for the Urban District Council. J. A. Robson, architect, Langley Moor.

Cardiff.—July 18th. Electric light wiring and fittings in concrete houses at Ely. City Electrical Engineer, Cardiff.

Edinburgh.—July 11th. Electricity Supply Department. Storage battery (Specification No. 35). (July 1st.)

France.—July 15th. The French Ministry of Posts and Telegraphs. Miscellaneous telegraph material, including 15,000 zincs for Callaud batteries, 60,000 zinc rods for Leclanché batteries, 20,000 zincs for manganese batteries, 20,000 compound positives for Leclanché batteries and 15,000 compound positives for manganese cells. In the case of the first three lots, the successful tendering firm will be required to manufacture the new supplies from existing old material. Particulars from the Service de la Verification du Matériel, 75, Boulevard Brune ; tenders are to be sent to the Direction de l'Exploitation Telegraphique, 103, Rue de Grenelle, Paris.

Glasgow.—The District Committee of the Tower Ward of the County of Lanark. Electric lighting for 50 houses to be erected at Gartcosh. Mr. Jas. A. McCallum, District Clerk, 15, West George Street, Glasgow.

Holmfirth.—July 15th. Urban District Council Electricity Department. One 60-kW, 480-V d.c. generator, shunt-wound, with regulator and slide rails. (See this issue.)

Ilford.—July 11th. Electric light installation, Christchurch Road School, for the Electricity Committee. Mr. A. H. Shaw, electrical engineer, Ley Street.

Jugo-Slavia.—July 13th. Minister of Posts and Telegraphs. Telephone material.*

London.—L.C.C. July 11th. Supplying and laying h.p. electric cables, &c. (June 24th.)

Metropolitan Asylums Board. July 20th. Alterations and repairs to the electric lighting, fire alarms and domestic bell installations at St. George's Home, Chelsea. (See this issue.)

Manchester.—July 12th. Tramways Committee. Steel tramway poles and silicium bronze trolley wire. Mr. J. M. McElroy, General Manager.

July 29th. Electricity Committee. Five 2,500-kW rotary converters, static transformers, switchgear, two l.p. starting transformers, &c., or motor-converters, switchgear, &c., and one 1,500-kW rotary converter, static transformer, switchgear, l.p. starting transformer, &c., or motor-converter, switchgear, &c. (See this issue.)

Mexborough.—July 23rd. Urban District Council. Electricity Department. E.h.p. switchgear ; l.p., d.c. switchboard. (July 1st.)

Newport.—July 25th. Electricity Department. 750-kW rotary converter, transformer and switchgear. (See this issue.)

Rhyl.—July 9th. Urban District Council. Electricity Department. 1,000 yd. 3 × 3 × 15 l.p. cable, one 5-way feeder pillar, switchboard panel and gear. (June 24th.)

South Africa.—BARBERTON. — July 29th. Municipal Council. Plant in connection with the proposed scheme for the supply of electricity :—Two steam boilers, two 75-kW steam-driven alternators, switchboard, and instruments, steel chimney, piping, feed pumps, cables, &c., steel poles, conductors, &c., transformers, house service meters, &c. Specifications, £2 2s., from Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.

Southampton. — July 9th. Electricity Department. Twelve months' supply of meters. (July 1st.)

Spain.—August 1st. Municipality of San Sebastian (Guipuzcoa). Supply and installation of the electrical material required for the new lighting system of the town.—*Reuter's Trade Service* (Madrid).

Uruguay. — MONTE VIDEO. — September 3rd. State Electricity Works. The Commercial Secretary to His Majesty's Legation at Monte Video reports by cable to the Department of Overseas Trade, that the local authorities are advertising for tenders for the supply of 59,250 metallic-filament lamps of assorted sizes, from 10 to 300 c.p., 225 volts, which are required by the State Power House.

*** A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.**

CLOSED.

Australia.—Sydney City Council has accepted a Victorian tender of £125,000 for turbo-alternators in connection with the installation of new plant, costing £500,000.—*Reuter's Trade Service* (Sydney).

MELBOURNE.—The Victorian Electricity Commissioners have accepted the tender of Messrs. Milliken Bros., London, of £72,858, for the construction of 643 galvanised steel towers for the transmission of power from Morwell to Melbourne. Messrs. Milliken's tender was £23,250 under the lowest tender for manufacture in Australia.—*Reuter's Trade Service* (Melbourne).

Belgium.—Six concerns submitted tenders, last week, to the Belgian Post and Telegraph authorities in Brussels for the supply of a quantity of cable heads, the lowest (15,430 francs) being that of P. Wilhelm, of Brussels. The offers varied considerably, one firm quoting up to 66,185 francs.

France.—The French Ministry of the Colonies in Paris has just placed a contract with the Société d'Electro-Metallurgie de Dives for the supply of 8 tons of high-conductivity copper wire at 5,530 francs per metric ton and 500 kilog. of bronze wire at 703 francs per 100 kilog.

London.—ST. MARYLEBONE.—Electricity Department. Recommended :—

House service meters for one year.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.

Steelwork required for the boiler-house and pump-room extension, £8,500. —Sanders & Forster, Ltd.

Mexborough.—Urban District Council. Accepted :—

One 750-kW rotary converter, with transformer, £4,405.—General Electric Co., Ltd.

Salford.—Tramways Committee. Accepted :—

Four tramcar controllers, £300.—English Electric Co., Ltd.

Electricity Committee. Accepted :—

L.p. cable, various sizes, in connection with the housing scheme at Lower Kersal and Weaste, £948 (approx.).—Enfield Ediswan Cable Works, Ltd.

Additional plant for the two new water-tube boilers, comprising steel chimneys and flues, induced-draught plant, coal bunkers and supplementary oil burners, £7,897.—Babcock & Wilcox, Ltd.

"Usco" ash-handling plant in connection with the two new water-tube boilers, £3,144.—Underfeed Stoker Co., Ltd.

Three cast-iron feed-water tanks, £326.—J. Wolstenholme & Son, Ltd.

Duplicate feed-water heater, £170.—J. & G. Weir, Ltd.

Warrington.—The Electricity and Tramways Committee has cancelled its contract with the Anglo-Belgian Improvements Corporation for tramway rails.

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—Friday, July 15th. At Caxton Hall, Caxton Street, Westminster, S.W. At 2 p.m. Annual Congress.

A New Turbo-electric Locomotive.—The new turbo-electric locomotive intended for use on railways, which has been patented by Mr. Ramsay, of Newcastle-on-Tyne, is creating keen interest in railway and engineering circles. The locomotive has been built at Messrs. Armstrong's works, and will shortly undergo its trials ; the London and North-Western Railway Co. will carry out the experiments. Either oil or coal can be burnt in the ordinary boiler, which supplies steam to a turbine, the latter in turn driving an electrical generator. The turbine exhausts into an air-cooled condenser, and important economies are expected to be realised by the use of this new type of locomotive. Existing engine frames can be fitted with the new equipment with very little alteration. The first steam-electric locomotive was the Heilmann type, which was tried some 20 years ago.

UNEMPLOYMENT INSURANCE.

By JOS. J. H. STANSFIELD, F.C.I.S.

In the issue of July 1st, it was stated that the weekly rates payable by employed persons and employers were to be increased as from July 4th, and the rates were given for comparison with those previously payable.

It was also stated that a Bill had been presented by Dr. Macnamara which would, if passed, increase these rates before the Act which was passed last March came into force, and that details would, in due course, be published.

These are now to hand, and from the comparison which is given below it will be noted how materially the rates have been increased.

	August, 1920.	*July, 1921.*	*July, 1921 amended.*
From the Employed Person.			
Men	4d.	5d.	7d.
Women	3d.	4d.	6d.
Boys under 18 ...	2d.	2½d.	3½d.
Girls „ „ ...	1½d.	2d.	3d.
From the Employer.			
Men	4d.	6d.	8d.
Women	3½d.	5d.	7d.
Boys under 18 ...	2d.	2½d.	4d.
Girls „ „ ...	2d.	2d.	3½d.

Unfortunately the increased rates do not mean increased benefits, for unemployment benefit is to be reduced as follows :—

	£ s. d.	s. d.
Men	From 1 0 0	to 15 0
Women	From 0 16 0	to 12 0
Boys...	From 0 10 0	to 7 6
Girls...	From 0 8 0	to 6 0

NOTES.

Educational.—The Education Committee of the London County Council has prepared a schedule of revised fees for day and evening courses at the technical institutes, &c., maintained or aided by the Council. Generally, the minima proposed are not greatly in excess of the existing fees, and in some instances no alteration is suggested, but in one or two cases the recommended increase represents a considerable advance. Upon the whole, the fees for technical and apprenticeship courses are not augmented to a large extent. The effects of the adoption of the schedule are briefly summarised by the Finance Committee as follows :—Under existing conditions the percentage of fees to total expenditure in maintained technical institutes for the year 1921-22 would be 3·5 ; and for polytechnics, &c., 14·5. Under the schedule these percentages will be raised to 6·2 and 19·4 respectively.

The Education Committee also recommends a grant of £5,000 towards the cost of completing the south-west wing of the Engineering Department of University College. In connection with this, it is stated that £70,000 is required for building and initial equipment and £30,000 for maintaining and improving equipment. £33,000 has been subscribed in response to an appeal for funds, and Lord Cowdray has promised £10,000 as soon as the initial £70,000 has been raised.

Students from the Dominions.—On Monday the Government entertained the delegates to the Congress of the Universities of the Empire at luncheon at the Savoy Hotel. Mr. A. J. Balfour presided, and, referring to the increased appreciation of University training which had been manifested since the war, emphasised the value of exchange of students and teachers with the United States. Sir Robert Falconer (president of the University of Toronto) said that in the Dominions the same demand for higher education was experienced, and it was of the utmost importance that the British universities should become a centre to which the Dominion graduates would turn after they had completed their work overseas. For years to come they would be reluctant to go to German universities, and the old universities would benefit by the influx of the vigorous youth from the Dominions.

The Cost of Printing and Publishing.—In reply to a letter in *The Times*, signed by a number of officers of learned societies and librarians, and protesting against the high price of scientific and other serious books, Mr. Geoffrey S. Williams, president of the Publishers' Association, points out that publishers are dependent on the printing, binding, and paper-making trades, and cannot possibly issue books at lower prices until the charges made by these trades are materially reduced. The cost of printing, he states, is now about 2¾ times what it was in 1914 ; paper (of an inferior quality) costs more than double ; binding (also inferior) costs over three times as much, and the total cost of a large edition of a small book works out at 180 per cent. above the 1914 figure. The maximum increase in the selling price, however, is 150 per cent. above the 1914 price, and it is generally much less. In the case of scientific books the cost of production has been trebled since 1914. The cost of materials has begun to fall, but wages, which are the dominant factor, remain at the highest point yet reached.

Appointments Vacant.—Teacher in electrical engineering, for the East Ham Technical College ; evening classes demonstrator in electrical engineering, for the City and Guilds Engineering College ; telephone inspector (£250 + £115), for the Government of British Guiana. For particulars, see our advertisement pages to-day.

Fatality.—"Death from misadventure" was the verdict at an inquest held on June 30th, at New Tredegar, on a boy of 10 who, while attempting to reach a bird's nest, came into contact with a wire carrying current at 3,000 V, at the engine house of the Old Pit. A companion said the lad was in flames on the wire when he looked round. The colliery engineer, Mr. W. J. Jones, undertook to carry out certain precautionary measures with a view to preventing such accidents in the future.

Electric Cooking Tests.—A considerable advance in the efficiency of electric cooking is indicated by a report of tests carried out with "Lightning" ovens for various classes of cooking. The information has been supplied by Electrical Utilities, Ltd., from details gathered from various sources. Joints of meat ranging in weight from 2·5 to 25·75 lb. were cooked ; the energy consumption in the case of the former was ·987 kWh, and the loss in cooking, 6·33 per cent. The wastage in the case of the largest joint was only 3·22 per cent., and the energy consumption 2·25 kWh. The results are naturally better for the larger joints, as an appreciable portion of the energy is absorbed in raising the temperature of the oven. It is possible to bake 18 lb. of bread at one time in the oven, and the energy consumption for this is about 1·5 kWh. For cooking cakes it is necessary first to heat the oven for 15 minutes, which takes about ·5 kWh; the actual cooking only consumes ·33 kWh.

A Russian Electrical Congress.—An important electrical congress has just been held in Moscow. At one of the sessions the chairman, Bashkoff, said that the position of the electrical industry in the country was a very difficult one, mostly because of the scarcity of skilled hands. He warned his hearers that the electrical industry had to confront a great problem, and that all their energies must be directed to its solution, taking account of all possibilities. There was relatively very little electrical material available, but still they must not be pessimistic. In the country there was yet a fair quantity of electrical equipment. What was wanted was its proper distribution amongst those who could use it. In this direction a great deal had already been done, but the organisation might be much better. It must be more systematic. Greater scope must be left to the local councils in the matter of electricity, and assistance should be given by the formation of local committees, the whole, however, being controlled by the Chief Department of Electrical Industry. In the discussion following the chairman's address, a number of delegates held that fixed prices must be made for goods, particularly for the smaller industries ; the importance of local manufacture of electrical material was insisted on, and also that the central body should organise industries in various localities where hands should be instructed or encouraged to make themselves acquainted with the industry, so that they might be fit to be employed in the larger factories later.

Tall Stories from the Tropics.—Under this heading the *Evening Standard*, of July 2nd, printed the following startling item :—"Weird tales of the tropics were told by Captain R. H. Torrible, of the steamer *Denis*, which plies between New York and Manaos, a port about a thousand miles up the Amazon River. What is more, says the Central News New York correspondent, the captain declared that, strange as were the things he described, they were quite true.

"He told how on a river that empties into the Amazon, near Manaos, he saw myriads of electric eels so strongly charged with electricity that the bottom of the stream was flooded with light, and the crew were able to read their pocket Bibles by the glow, which was estimated at 40 watts per eel.

"When some of the eels were brought on deck, the captain added, the ship's dynamos were short-circuited. When the vessel was tied up at the pier a boy fell into the river. The eels surged round him, and when he was taken out of the water he was dead. A doctor who examined the body said the lad had been killed by an overcharge of electricity."

We knew there was a strong current in the Amazon, but evidently the eels make light of it.

Industry and Cheap Fuel.—An important statement has been submitted to the Prime Minister by the National Federation of Iron and Steel Manufacturers and the Iron and Steel Trades Confederation (representing the workers), with regard to the condition of the iron and steel industry, which occupies 1¼ million workers. As the result of the coal strike, the industry is at a standstill, and destitution prevails in iron and steel producing districts throughout the country. European competition is severe owing to the low level of real wages in Germany, due partly to the fact that the German working classes are working up from the very low standard of living imposed by our blockade during the war, and are, therefore, for the present, relatively content with advances in wages which leave their real earnings still far below the pre-war level ; and partly to the system of family and other bonuses, which enable the working man to meet his expenses at a minimum cost to the total wages bill. These considerations apply, though to a less extent, in France and Belgium.

It is the considered opinion of employers in the trade that, in view of foreign conditions, the industry will not be able to re-start unless fuel, as well as other items of cost, is reduced to a level not higher than from 75 to 100 per cent. above pre-war values.

A Municipal Vehicle Demonstration.—With regard to the note under the above heading on p. 821 of our issue of June 24th, it was stated in error that Messrs. Electricars had on view a 15-cwt. vehicle, whereas it actually had a 50-cwt. carrying capacity. The chassis was an improved type of the model originally produced by Messrs. Edison Accumulators, Ltd. It is known as the Model "E.A.," and has proved to be very satisfactory. The chassis frame is of the built-up type, the side members being constructed of two high-tensile steel fitch plates reinforced by well-seasoned American ash filler pieces. Solid-drawn steel tube cross members are used, and the rear wheels are each driven independently through totally-enclosed continuously-lubricated gearing from a series-wound motor, which is mounted outside the chassis frame, thus providing accessibility should the brush gear need adjustment. The controller box is also mounted outside the frame on the near side immediately behind the front mudguard; the battery compartments are situated under the driver's seat, and under the bonnet in front of the dash respectively.

The body, which is entirely constructed of sheet-steel, is tipped by an automatic electric tipping gear, which is put into action by a simple reversing switch. As soon as the switch is closed, a small electric motor raises the front end of the body by means of a square-threaded screw (through a suitable reduction gear), and a nut to which is anchored a series of toggle-jointed levers which have a scissor-like action. The process of tipping is effected within 30 seconds. All channel section bracing pieces are kept on the outside of the body, thus allowing the load a clean sweep when tipping.

At present this type of vehicle is manufactured in two sizes, which have carrying capacities of 60 and 70 cwt. respectively.

Railway Electrification.—In the Swedish daily paper, *Nya Dagens Allehanda*, for April 7th, Mr. C. Rossander, one of the leading consulting engineers of Stockholm, gave an interesting account of a five weeks' tour he had just carried out in Germany, France and Switzerland on behalf of the Swedish State Railway Electrification Committee.

It is proposed to carry out the electrification of all the main lines in Sweden, and it was almost decided to employ single-phase a.c., excellent results having already been obtained with that system on the section, Gellivare-Riksgraensen. But when the engineers were considering the next portion to be electrified, *i.e.*, Stockholm-Gothenburg, the possibilities of danger to the telephone system, the lines of which follow the railway, were realised, and it was desired to consider the practicability of employing direct current. This was the main object of Mr. Rossander's tour, with the study of mercury rectifiers as a special inquiry.

Mr. Rossander visited the works of Messrs. Brown, Boveri at Baden and at Mannheim, rectifiers being constructed at both factories. He also inspected the apparatus under working conditions at Berne, and in the Cologne district. The plants in both cases had been in use for two years, were designed for 600 volts, and were employed for tramway work, with excellent results. The German A.E.G. and Siemens concerns were reported to have taken up the manufacture of mercury rectifiers seriously.

For the purpose of the Swedish State Railways a pressure of 600 volts was insufficient, in fact 3,000 volts would be desirable, but no mercury rectifiers have yet been constructed for such a high pressure.

Mr. Rossander ascertained that Messrs. Brown, Boveri had undertaken to supply a number of rectifiers for 1,500 volts pressure for an electrified railway in the South of France, under the severe condition that if they did not function entirely satisfactorily they would be rejected. The makers felt confidence in their ability to carry out the contract satisfactorily.

Mr. Rossander reports finding the question of railway electrification exciting wide interest abroad. In France the matter is mainly in the planning stage, although attempts at standardisation are being made, and systems previously employing alternating current have been converted to direct current at 1,500 volts.

In Switzerland electrification is in rapid progress, the single-phase system being used almost exclusively.

Mr. Rossander had an opportunity of inspecting the power station at Lyons, whence power is distributed to three power stations and two sub-stations, all coupled in series. Direct current at from 70,000 to 100,000 volts pressure is employed, and the whole system has been found exceedingly reliable. The French Company, Société Anonyme des Ateliers de Secheron, makes a speciality of this class of business, and is at present co-operating with Messrs. Brown, Boveri in working out a scheme for electrical power transmission from Norway to Denmark, which is thought to be practicable at 300,000 volts d.c.

Dyke's Automatic Electric Buoy Lamp.—Since the repair of the first submarine telegraph cable, the need of adequate means of illumination for mark buoys during night operation has been felt by all repairing ships. At the present time the original type of oil lamp, with a few improvements, is still in use, but is far from satisfactory; therefore, with these defects in mind, an automatic electric buoy lamp was produced, and was patented in America in August, 1919.

The following description of the lamp and its method of operation is abstracted from the *T. and T. Age*:—

The lower part of the lamp consists of a circular, watertight, galvanised sheet iron can.

The top closure plate contains an opening in its centre, around the upper edge of which is a small metal collar holding a circular dioptric lens. A second closure plate, having a similar metal collar on its under side, covers the top of the lens, rubber gaskets being used to make the junction of the lens and the closure plates watertight. The can contains a wooden carrier supporting eight dry cells and an eight-day clock, the gearing of which is so constructed that the arbor of the clock revolves once in 24 hours, and is provided with a timing disk, which is made of insulating material and is secured in position on the arbor by a wing nut. The face of the disk is divided into twenty-four hours, the numbering of the divisions being in two groups of twelve hours each. A portion of the periphery of the disk is slightly cut away and a segmental metal contact plate inset, the length of which depends on the number of hours the light is required to burn. A pair of contact fingers are mounted on a small insulating block on the frame of the clock at the side of the disk. The ends of the contact fingers rest firmly on the periphery of the disk, and the tips of the contact fingers and also the segmental contact piece in the disk are gold plated to prevent corrosion by the sea air and to give as perfect a contact as possible. The eight dry cells are connected in series-parallel to give from 5 to 6 volts, the lamps being 5.5-volt ones, taking .30 ampere each.

The method of operation is as follows: Assuming that an eight-hour disk is being used having the contact piece inset from 8 p.m. to 4 a.m., if the lamp is being placed on the buoy at 2 p.m., the wing nut holding the disk is loosened and the disk turned until the division marked 2 p.m. comes directly under the point of contact of the two fingers. The wing nut is then tightened, and the lamp assembled and made ready for use. The method of attaching the lamp to the buoy staff is immaterial so long as it is securely held in place. As the contact fingers now rest on the insulated portion of the disk periphery, there will be no circuit between the battery and the lamps, but as the disk revolves, the contact piece will come under the contact fingers at 8 p.m., and the lamp will then light and continue thus until 4 a.m., when the contact piece will pass from under the fingers, thus extinguishing the light. This cycle of operations will continue until the timing mechanism stops, which occurs generally on the tenth day. Experimental models of this lamp have been supplied to the Commercial Cable Co., the French Cable Co., and the Western Union Cable System, and have proved satisfactory in operation.

The Bastian Electric Co, Ltd.—The adjourned petition of W. F. N. May and Another for an order for the compulsory liquidation of this company was again before Mr. Justice P. O. Lawrence in the Companies' Winding-up Court on Tuesday. Negotiations for a settlement with the petitioners have been going on for some weeks, and it was now stated that no settlement had been reached yet. But a certain sum had been found, and that was the inducement to ask for another week's adjournment. This was granted.

INSTITUTION NOTES.

Institution of Electrical Engineers' Conversazione.—The following is a list of the principal guests present at the conversazione of the Institution, at the Natural History Museum, South Kensington, on Thursday last week:—

Sir William Barrett.
Sir Tom Callender, J.P.
Sir G. H. Collier.
Sir Robert Elliott Cooper.
Sir H. J. Creedy.
Sir Philip Dawson.
Sir G. K. B. Elphinstone.
Sir Arnold B. Gridley, K.B.E.
Sir S. F. Harmer.
Sir A. W. Watson.
Brigadier-General Sir W. T. F. Horwood.
Sir Herbert Jackson.
Rear-Admiral F. C. Learmouth.
Sir Gerard and Lady Muntz.
Sir Philip Nash.
Sir A. M. J. Ogilvie, K.B.E., C.B.
Vice-Admiral Sir Laurence Power.

Delegates of American Engineering Institutions:—

Mr. Ambrose Swasey.
Colonel A. S. Dwight.
Mr. Charles F. Rand.
Dr. Ira N. Hollis.
Mr. John R. Freeman.
Mr. Charles T. Main.
Mr. Robert A. Cummings.
Mr. Jesse M. Smith.
Dr. F. B. Jewett.
Mr. William Kelly.

Members of Council:—

Mr. W. A. Chamen.
Mr. H. W. Clothier.
Mr. J. R. Cowie.
Col. R. E. Crompton, C.B.
Mr. W. Cross.
Sir James Devonshire, K.B.E.
Dr. W. H. Eccles.
Mr. S. E. Fedden.
Dr. C. C. Garrard.
Mr. F. Gill, C.B.E.
Mr. J. S. Highfield.
Mr. P. V. Hunter, C.B.E.
Sir William Noble.
Mr. C. C. Paterson, O.B.E.
Dr. A. Russell.
Mr. W. M. Selvey.
Mr. Roger T. Smith.
Mr. C. P. Sparks, C.B.E.
Mr. A. A. C. Swinton.
Mr. C. H. Wordingham, C.B.E.
Mr. P. F. Rowell, Secretary

The president, Mr. Ll. B. Atkinson, and Mrs. Atkinson, with the Council of the Institution, received the guests, who numbered in all about 1,500. An excellent programme of music was provided by the string band of the Royal Engineers, under Lieut. Neville Flux, F.R.A.M., and a concert in three sections was given by Miss Phyllis Carey-Foster and Miss May Peters, with the Allied String Quartet. At 10 o'clock the gathering was called to attention by the notes of a bugle, and the President introduced Mr. Ambrose Swasey, chairman of the deputation of American engineers in this country, referring to his great achievements in connection with the construction of the largest telescopes in the world, as well as Dr. F. B. Jewett, Vice-President of the American Institute of Electrical Engineers, and chairman of the electrical branch of the delegation, who recently gave a lecture on research before the Institution, and is at the head of the largest research organisation in the world. Mr. Swasey expressed his admiration at the manner in which the British nation had come through the war, and still maintained its upright and resolute attitude in the face of the many difficulties with which it had to contend; he expressed the firm solidarity between the United States and the British Empire, and advocated the utmost possible co-operation between the two nations, in the best interests of the whole world. Dr. Jewett, after heartily endorsing these sentiments, read a letter from Mr. A. W. Berresford, President of the American I.E.E., to the same effect, the message being greeted with enthusiastic applause.

The offer of Mr. E. M. Hughman, of Bombay, to give a donation of £250 to the Benevolent Fund of the Institution of Electrical Engineers, on condition that 19 similar amounts were contributed by June 30th, has been extended by him to December 31st, 1921.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. H. L. KIRBY JOHNSON has commenced business at 68, Gordon Street, Glasgow, and has been appointed representative for Scotland for Messrs. Drake & Gorham Wholesale, Ltd., of London. For the last eight years Mr. Johnson has been supply department branch manager for Scotland with the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, and on severing his connection with this company, he was the recipient of a silver cigarette and cigar box from his colleagues in Glasgow and Manchester.

Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., have secured the services of MR. R. P. TOD, M.I.Mech.E., M.I.Met., in connection with their hydro-electric work. Mr. Tod has been at the British Aluminium Co.'s Works, at Kinlochleven, since 1907, and readers who have visited these works will know him as having been originally in charge there of the erection of the pipe lines and turbines of 30,000 h.p. Until recently Mr. Tod has been manager-in-chief over the whole of the British Aluminium Co.'s undertaking at Kinlochleven.

COL. and MRS. CROMPTON recently celebrated their golden wedding, and several of Col. Crompton's old pupils (through the instrumentality of Mr. Llewellyn Foster) took the opportunity to present them with a small token of their esteem, affection and goodwill. This gift, which has been suitably acknowledged by Mrs. Crompton, was accompanied by an album containing the signatures of those who contributed.

After considering 190 applications for the position, the Wallasey Electricity Committee is recommending the appointment of MR. B. T. HAWKINS, electrical engineer to the St. Helens Corporation, as electrical engineer and manager of the Wallasey undertaking, in succession to Mr. J. A. Crowther who resigned. The salary recommended is £1,000 per annum, or £900 if the electrical engineer is allowed to take two articled pupils.

Darwen Town Council has been recommended to increase the salary of MR. PERCY TAYLOR, assistant electrical engineer, from £250 per annum to the basic salary of £427, rising by three instalments to £471, with the usual bonus from November 20th last, in accordance with the schedule of salaries of the National Joint Board.

MR. JOHN MCDONALD, late of the Telegraph Department, Post Office, Aberdeen, who left this country a few months ago to take up a post under the Colonial Government, has been appointed traffic manager for the telegraph system of East Africa and Uganda, with headquarters at Nairobi.

MR. R. A. WATSON WATT, Brechin, has been appointed superintendent of the Radio Research Board Wireless Station, Aldershot.

The Wigan Corporation has appointed MR. W. M. MILNES, of Coventry, tramway manager, at £700 a year.

MR. W. S. ASKHAM (of 17, Regent Park Terrace, Hyde Park, Leeds) announces that he has severed his connection as North Country representative with Messrs. J. H. Tucker & Co., Ltd., after 17 years' service, and has joined Messrs. J. A. Crabtree & Co., Ltd., of Walsall.

We understand that MR. CHARLES L. TOMLINSON, late sales manager for primary and secondary batteries to the Edison and Swan Co., Ltd., has recently vacated an engagement he had taken up with the Hart Accumulator Co., Ltd.

MR. W. N. Y. KING, A.C.G.I., A.M.I.E.E., until recently associated with the Austin Motor Co., Ltd., has entered into partnership with MR. BRAZIER, under the style of Brazier & King, engineers, of 14, New Street, Birmingham; the firm will deal with electric power and lighting installations, factory equipment, steam plant, &c.

MR. H. C. LONES, of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., whose marriage to Miss Nellie L. Tregg, took place last week, has been presented by the staff with a clock.

MR. GEORGE HALLY, of Birmingham, has been appointed chief works manager of the engineering side of the Edison Swan Electric Co., Ltd., Ponder's End. We understand that Mr. Hally has had a wide experience with some of the leading firms of engineers in this country and abroad.

WILL.—MR. R. J. WEST, a director of the New General Traction Co. and the Norwich Electric Tramways Co., left £50,705.

NEW COMPANIES REGISTERED.

Alliance Wholesale Electrical, Ltd. (175,447).—Private company. Registered June 29th. Capital, £3,000 in £1 shares. To carry on the business of wholesale suppliers and manufacturers of and dealers in all machinery and apparatus used in connection with the generation, distribution, supply, accumulation, and employment of electricity, &c. The first directors are: W. F. White, 93, Hamlet Gardens, Ravenscourt Park, W. 6; H. J. Grant, 89, Carlton Mansions, Maida Vale, W. 9; Elizabeth McArthur, 11, Dorset Road, Merton Park, S.W. 19. Secretary: E. McArthur. Solicitor: W. P. Scott, 150-151, Fenchurch Street, E.C.

The Hugh Stanley Co., Ltd.—Private company. Registered in Dublin June 27th. Capital, £1,250 in £1 shares. To carry on the business of mechanical and electrical engineers, &c. The first directors are: D. Harrison, 75, South Circular Road, Dublin; A. R. Eliasoff, 75, South Circular Road, Dublin; H. Stanley, 17, Anglesea Street, Dublin. Registered office: 44, Temple Bar, Dublin.

Alexander Marshall & Co., Ltd. (11,772).—Registered in Edinburgh June 24th. Private company. Capital, £30,000 in £1 shares (15,000 preference). To acquire the business of a boiler and accessories maker carried on by A. Marshall, and to carry on the business of ironfounders, engineers, tube manufacturers, &c. The subscribers (each with one share) are: A. Marshall, Murrayfield, Motherwell, boiler maker; A. Marshall, junior, Murrayfield, Motherwell, boiler maker; J. Marshall, Murrayfield, Motherwell, boiler maker; J. Pitceathly, Glenparg, Hamilton, engineer; W. A. Campbell, Murrayfield, Motherwell, clerk; A. B. White, 1, Holyrood Crescent, Glasgow, boiler maker. The first directors are: A. Marshall, A. Marshall, junior, J. Marshall, J. Pitceathly, W. A. Campbell, and A. B. White. Qualification: 500 shares. Registered office: Coursington Road, Motherwell.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Frederick R. Butt & Co., Ltd.—Satisfaction to the extent of £2,000 on October 18th of debentures dated March 29th, 1920, securing £10,000 (notified June 24th, 1921).

Rawlings Bros., Ltd.—Satisfaction to the extent of £7,200 (balance) on March 31st, 1921, of charge dated December 4th, 1918, securing £8,750.

Lyell, Ltd.—Issue on June 17th, 1921, of £500 debentures, part of a series already registered.

Western Electric Co., Ltd. (106,921).—Return dated June 6th, 1921. Capital, £500,000 in £5 shares, 99,995 shares taken up, £155,975 paid, £344,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Great Northern Telegraph Co., Ltd., of Denmark.

In their report for 1920, to be submitted at the meeting at Copenhagen on July 16th, the directors say that the whole of the year passed without the minefields having been swept at the places where one Franco-Danish and one Anglo-Danish cable, as well as the cable between Petrograd and Libau, were broken, and repairs had consequently been impossible. There was, however, some prospect of the two first-mentioned cables being put in working order before long. Eight of the company's other European cables had been subject to 16 interruptions, whilst 19 interruptions had occurred in six of the Far East cables. The Wladiwostok and Kiachta routes are still closed so far as the transmission of traffic between Europe and the Far East is concerned, but the company's offices at Wladiwostock and Kiachta, as well as at Irkutsk, have throughout the year been worked by Danish staff who have transmitted the Siberian correspondence to and from Japan and China and beyond *via* the Wladiwostock-Nagasaki cables and the Irkutsk-Kiachta-Peking line respectively. The general conditions in Siberia are as yet not quite settled; at times it has proved difficult to furnish cash for the staffs at Irkutsk and Kiachta. At the beginning of 1921 the Kiachta-Peking line became interrupted

in Northern Mongolia, where Russo-Mongolian forces dislodged the Chinese troops and captured the town of Urga. It is impossible to predict when telegraphic connections between Kiachta and Peking may be re-established. The traffic over the company's cables both in Europe and the Far East has been satisfactory. The economic and industrial crisis, however, caused a decrease in the traffic carried over the company's European cables during the latter half of the year, and this decrease has continued during the early part of the current year. Compared with the corresponding period of 1920 the decrease is estimated at approximately 30 per cent. In the Far East the traffic carried during 1920 shows, on the other hand, an increase compared with that of 1919, but the reaction has set in also there, and the enormous traffic dealt with during the war and the period immediately after is gradually attaining more normal proportions. The negotiations with Poland have been continued. The object has been the laying of a cable between Denmark and a point on the Polish coast near Dantzig, and the working of the cable by the company's staff at Warsaw by means of an aerial wire to the landing place. It is very doubtful whether the negotiations will be brought to a successful issue, because the terms for laying and working the proposed cable, which the Polish Government has hitherto thought it possible to offer, are unacceptable to the company. The company had to close down in European Russia in April, 1918, when the company's routes became interrupted owing to the state of war between Russia and her western neighbours. It is important for both parties that the company should recommence its operations in Russia. The negotiations are being continued, and the board hopes that before long an arrangement will be arrived at which will make it possible for the company to reopen its station at Petrograd—where all the instruments are intact—as well as to take its proper share in the transmission of the traffic between Europe and the Far East *via* the Russian landlines to Irkutsk and Wladiwostock. Last year the directors expressed the opinion that the financial results of the year 1920 would not be as favourable as those of the year 1919. This forecast has proved wrong, the reason being the depreciation of the value of the Danish crown taken in relation to sterling, Mexican dollars, and yen, the currencies in which the principal income of the company is received. Whilst the company's receipts from the traffic between Europe and the Far East have decreased considerably owing to the continued interruption of the Siberian line, the satisfactory development of the telegraphic correspondence in 1920 taken as a whole has, to a certain extent, acted as a set-off. There appears no prospect of such compensation in the current year, and from the general nature and scope of the company's operations it is clear that it must feel the full effect of the world-wide stagnation of commerce, industry, and shipping. The proposed increase of the international telegraph rates, by which also the company should benefit, has been postponed *sine die*, and no important reduction in the enormous expenses under the heading "salaries, &c.," may be expected to take place until a general decrease in the cost of living has set in; therefore the immediate future is not very promising. It is proposed to distribute a total dividend and bonus of 24 per cent., or 2 per cent. more than for each of the previous three years. £285,892, or £144,285 more than last year, is carried forward.

J. G. White & Co., Ltd. The directors in their report for the year ended February 28th, 1921, say that during a considerable portion of the period the company was faced with difficult and anxious conditions. The result of working was a net profit of £4,207, which, with £15,286 brought forward, shows a credit in the profit and loss account of £19,493. In January last an interim dividend was paid on the 7 per cent. preference shares, absorbing £6,300, but in view of the general conditions obtaining to-day the board has come to the conclusion that the final dividend on the preference shares should not be paid at present, and recommends that the balance of £13,193 be carried forward. The nominal capital was increased to £500,000, and £150,000 of the reserve fund was capitalised in the form of ordinary shares, the issued amount of which now stands at £200,000. The conditions during most of the period under review were adverse to the contracting and construction business, but construction contracts on satisfactory terms, the results of which do not, however, affect the past year's trading accounts, have recently been entered into. J. G. White Commercial Co., Ltd., whose share capital is held by this company, has had to meet a period of almost complete stagnation in the South American trade, where confidence was severely tried by the effect of the break in prices on a market over-stocked with commodities. Since the autumn of last year there has been a continuous decline in market prices which has resulted in considerable losses to the Commercial Co. The precise extent of the loss cannot be gauged at the moment, but the position should be cleared by the end of the year and a sounder condition of things re-established.

Lisbon Electric Tramways, Ltd. The annual general meeting was held in London on June 29th, Mr. Ludwig Breitmeyer (chairman) presiding. The chairman said that the report covered two years—1919 and 1920, the collapse of the exchange in 1920 rendered this necessary. The company had sustained severe loss by the restrictions placed by the Portuguese Government upon remittances from the country, and also from the high price of coal which had reached 142s. per ton. Increased fares had been sanctioned, but these were insufficient to balance the rising costs. At present the lowest fare was equivalent to ¼d. About 8 per cent. of the traffic receipts had been paid to the Government, in addition to a tax upon tickets. The net result of working during the two years was a loss of £45,500. No provision had been made for depreciation since 1917, these arrears would have to be made good as soon as circumstances permitted. Every endeavour was being made to procure further tariff increases and to cut down expenditure to the lowest economic limit.

Mexican Light & Power Co., Ltd. A meeting of the holders of the company's 5 per cent. first mortgage gold bonds was held on June 29th, Mr. Harold G. Brown, representing the trustee (National Trust Co., Ltd.), presiding. Mr. E. R. Peacock (chairman of the Bondholders' Committee) dealt with the position of the undertakings under the *régime* of Presidents Diaz, Carranza, and Obregon, and stated that of late the position had been difficult owing to acute labour disturbances. He said that no arrears of interest were being paid at present, but it was hoped that the works in hand would result in ability to pay off the arrears on the first mortgage bonds. There was a prospect of several years' waiting before interest on the second mortgage bonds was available. A claim for damages amounting to 19,000,000 pesos had been lodged with the Government, and there was a reasonable prospect of this being paid. The working of the hydro-electric plants had been prejudiced by the scarcity of rain during last autumn, and the irregularity of the supply of fuel oil had also handicapped the steam reserves. Money for reconstruction purposes was not available; their efforts to secure payment of 7,000,000 pesos owing by the Government and the Mexico City authorities had been unsuccessful. Mr. Peacock was hopeful that in the future the position of the companies would steadily improve, although Mexico had many financial, social, and political difficulties to overcome.

Edmundson's Electricity Corporation, Ltd. The annual meeting was held on June 30th, at Winchester House, E.C., Mr. P. D. Tuckett presiding. The chairman congratulated the shareholders on the improved accounts, which enabled them to recommend the resumed payment of the cumulative preference dividend. In most cases their prices still lagged some way behind their costs, but they eventually succeeded in securing substantial increases in their authorised maximum rates, the relief so obtained, combined with the removal of the lighting restrictions and an increased power demand, enabling them to realise the better results shown, despite a further enormous increase in their wages and fuel bills. Apart from the Lancashire Power Co., their wages bill increased by over £40,000 and their fuel bill by over £64,000, yet the various undertakings managed to increase their gross profits by nearly £100,000. Of that increase about £17,000 appears in their profit and loss account, the balance having gone to outside shareholders or been applied in increasing the reserves set aside and the amounts carried forward by the sub-companies. The gross trading profit was increased by £1,800. In the earlier part of last year the contracting business was very active and the trading conditions were exceptionally favourable, whereas they had recently become the very reverse, so that for the current year they were likely to see a substantial drop in that item. With the balance of £10,090 brought forward there was a total available profit of £26,143, £12,000 of which they proposed to apply in the payment of one year's dividend on the cumulative preference shares, carrying forward £14,143. That still left the cumulative preference dividend one year in arrear, but under the present uncertain conditions, and in view of the necessity of making provision for the repayment of the three-year notes, they felt it would be imprudent to commit themselves prematurely to the wiping out of these arrears. So far as it was possible to forecast the future in these anxious and difficult times, they confidently believed that they had definitely turned the corner, but, until they enjoyed a return to more normal conditions and secured the regulation of their selling prices on a more permanent and rational basis, they could not be sure of the steadily improving results to which they looked forward. Proceeding to refer to the conditions governing their authorised rates of charge, which were still far from satisfactory, he said that most of their maximum rates had been granted, and with very few exceptions any further adjustment of them could only be made, under the powers of the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, which restricted profits to an amount sufficient to yield three-quarters of the average pre-war ordinary dividend. A more stupidly unfair and utterly uncommercial restriction to impose on a progressive industry it was difficult to imagine, and he entirely failed to understand how it was supposed that any healthy progress could be made under such conditions. It condemned them to a smaller return than they were earning before the war, despite the fact that their connected load had increased by over 80 per cent. in the intervening seven years, and that plant which was then only partially loaded was now in many cases overloaded. Under such circumstances what inducement could there be to extend the business by the expenditure of further capital, even if the cost of capital were not now nearly

twice what it was? The increased rates, which they had been granted, materially eased the position with which they were confronted last year, but under existing conditions of cost they were still in most cases quite inadequate to afford a reasonable return on capital. Small undertakings had been far more seriously affected than the larger ones by the conditions which the war had brought about. Speaking generally, they were called upon to bear increased costs relatively twice as great as those which the larger undertakings were carrying. Before the war 8d. per unit was the general authorised maximum rate for large and small undertakings alike, irrespective of the character of their areas of supply. That afforded the smaller undertakings a sufficient margin over the lighting rates which they actually required to charge, whilst it gave the larger undertakings a more than ample margin over theirs. As it was, the smaller undertakings had no longer any margin, and consequently their maximum rates had practically become their standard lighting rates, in order that they might recover from the more remunerative consumers the losses they were obliged to incur in supplying the less remunerative. It was a miserably unsatisfactory state of things that they should be forced to conduct a commercial business in such a way, with no freedom to vary prices in accordance with the varying conditions. His own feeling was that the whole system of control by maximum rates was wrong. Either they were high enough to be inoperative, as before the war, or by their inadequacy, as at present, they ran counter to every economic law and so destroyed the very basis on which the development of the business depended. Last year they promoted a Bill, under which they sought power to establish a sliding scale of prices and dividends. He thought it was a great pity that it failed to receive more sympathetic consideration from Parliament, for he could not help believing that the principle which it embodied, securing a reasonable latitude in the matter of prices, would be in the best interests of the consumer no less than in their own, and would prove entirely practical and fair. However, they had to deal with the situation as it existed, and they would naturally wish to know what hope there was of getting the paralysing conditions, to which he had referred, removed. First there was the possibility, and he hoped the probability, of costs falling, and this would, of course, afford far the most satisfactory means of enabling prices to overtake costs, but even so, they would still require the removal of the statutory restriction now imposed on their earning powers. Provision was made for that in the Electricity (Supply) Bill now before Parliament, but, as other clauses of the Bill dealing with the setting up of Joint Electricity Authorities were likely to meet with strenuous opposition, he feared the Government might sacrifice their needs to the exigencies of the political situation, and fail to secure for the Ministry of Transport the enlarged powers with regard to prices which it was so vital for them to possess. The position in which the smaller companies were at present placed was, however, so manifestly and flagrantly unfair, besides being so detrimental to the interests of the districts they served, that it was impossible to believe that it could be allowed to continue indefinitely. It had already been remedied in the case of the gas and other public service undertakings, and he felt sure that the Electricity Commissioners would endeavour to get it remedied in their case also with as little delay as possible. The gross profit increase of nearly £100,000 on the various undertakings was gratifying in so far as it went, but it was also a measure of the crippling loss which they were most undeservedly called upon to suffer as the result of their unrelieved distress, or at any rate of the utterly inadequate and belated relief which they received, during the two previous years, for, even now, despite their largely increased load, they were not as well off as before the war. Omitting the Lancashire Power Co., the connections showed an increase of 8,358 kW, compared with 7,356 kW the previous year, and capital expenditure an increase of £125,176, as compared with £149,476. For the current year, and in future, until they were once more allowed to conduct the business on a commercial basis, both these figures would show large reductions.

India-Rubber, Gutta Percha & Telegraph Works Co., Ltd.

The directors have communicated with the shareholders as follows, under date June 29th "As the circular letter of 28th ult. appears to have given rise to some misunderstanding, the directors desire to make the matter clear by a brief statement of facts which have occurred since the last general meeting, and which again render it impossible for them to recommend the payment of any dividend on the ordinary shares for the same reason given at the annual general meeting, viz., the shortage of cash. In the chairman's speech at the last general meeting the cause of the then cash shortage was explained in detail, and the belief expressed that the cash position would be greatly improved within the next six months. But such, unfortunately, has not been the case, owing in a great measure to the extraordinary slump in trade generally and the tire section in particular. This condition of trade left us with stocks difficult to move, and forward commitments which had to be met, with the result that the cash position has not improved. We have realised a considerable amount of our colonial stocks, but our home market has not been able to consume enough of our Persan manufactured articles to greatly influence the return to England, by means of the sale of these goods, of the capital which had been deflected to France during the war. Labour unrest generally, culminating in the present coal strike, has caused throughout the country an extraordinary dislocation of industry of far-reaching effect, difficult to measure and not easy to cope with. Under the existing conditions of disorganised trade, it is difficult to forecast the future, but a clear line of action is indicated along which the company must work, and that is to produce and sell goods at a price within the consumer's reach, and to readjust the present inflated wages to such a figure as will enable us to do so on a profitable basis. Your directors are pleased to inform you that our workpeople at Silvertown are looking wisely at the economic position as it affects them, and we have already been able to make an arrangement with them which has brought about a preliminary reduction in wages. In the near future we expect to meet considerable competition from those countries where the rate of exchange and cost of living make cheap production possible. Nevertheless, your directors have a feeling of confidence that the company will be able to steer through the troublous times ahead—aided by new methods and by economical and efficient labour and administration. With all hands pulling together in the true interests of the company, as is their duty, we may perhaps be able to look back at the coal strike as a blessing in disguise, however hard the country may have been hit by this action of gross economic folly."

West India and Panama Telegraph Co., Ltd.

At the meeting held on June 29th, Sir A. F. King, who presided, said that in the report of a year ago they said that 1919 had been the most disastrous year in the history of the company. They then hoped, and thought, that the company had touched bottom; but they were wrong, for in the year now under review the company sank even lower. They had, after several previous forecasts, been led to expect that the company's cable steamer would be released from the Trinidad Dock by the end of June last, that was after 17 months' detention; she came out only in October, more than 20 months after she was handed over; and the cost of her survey and repairs, which had originally been estimated at about £10,000, came to as much as £74,252, nearly three and a half times the reserve of £21,589 which had been accumulated to meet her depreciation. But this heavy bill was only one of the unfortunate results of the long detention of the cable ship at Trinidad. In normal times with the ship available to effect quick repairs of interrupted cables, the company would have had funds in hand from traffic and other receipts with which to meet at any rate a considerable part of the excess of £53,000 over the ship's accumulated reserve; but, in the absence of the *Henry Holmes*, they found it impossible to get the cables repaired quickly, and naturally the traffic receipts fell off, so much so that they were in 1920 more than £30,000 less than in 1919. Consequently, to find the money for discharging their debt to the Trinidad Dock, for paying for the hire of cable ships, for buying new cable and for meeting increased expenses generally, they had been obliged to sell most of the company's investments—at a loss, owing to the state of the money market, of £30,555. They had also taken an opportunity which offered of issuing during this current year one hundred more debentures of £100 each. This third survey of the cable ship had in all cost the company: £74,252 payments to the Trinidad Dock and purchase of materials, £38,000 for hire of cable ships over and above what the cost would have been if the *Henry Holmes* had done the work, £31,370 reduced traffic receipts, £30,555 loss on sale of investments, £12,450 forfeited subsidies, totalling £186,627, of which about £137,134 was proper to the year 1920. The speaker went on to refer to the various items in the accounts. We published the directors' report in our last issue. In conclusion, the chairman said that they were told that it was the intention of one of the large American cable companies to lay a cable from Porto Rico to Cuba, whence they already had cables to New York. This cable, when it began working, could not fail to be a serious rival to the company, and it must have considerable effect on their revenue in Porto Rico.

French Companies.

The Société du Matériel Isolant, of Lyons, reports that its factory for the manufacture of "clematite" is fully equipped for meeting requirements in insulating materials, and that the net profits of 302,000 fr. in 1920 permit of the payment of a dividend of 60 fr. net per share.

The Compagnie Générale de Constructions de Locomotives (Batignolles-Chatillon) reports net profits of 303,000 fr. for 1920, which amount has been carried forward. Apart from steam locomotives, the directors state that foreseeing that the projected electrification of the railways would be capable of providing work for the shops, they had entered into an agreement with the Société de Construction des Batignolles and the Société Oerlikon for the construction of electric locomotives.

The report of the *Société Anonyme des Etablissements Industriels de E.C. Grammont et de Alexandre Grammont*, which was submitted at the special meeting held on June 18th, stated that thanks to the development of new manufactures it had been possible for the company advantageously to guard against the general industrial crisis, and that despite a strike in March and April, 1920, the value of the turnover in 1920-21 was greater than in the preceding year. The participations had been extended in various associated undertakings, and the company in connection with its subsidiaries

had formed an export department which had already negotiated foreign transactions, which required large capital resources, owing to the long periods of transport and of credit. In order to deal with the considerable orders expected, particularly from public authorities, for the construction of long-distance telephone cables, it was necessary to have a basis as large and sound as possible from the financial point of view, especially in order to place the company on a level with its most direct competitors. Having regard to these circumstances the directors proposed and the shareholders sanctioned an increase in the share capital from 30,000,000 to 50,000,000 fr.

The Société des Ateliers de Constructions Electriques du Nord et de l'Est (Jeumont), at the general meeting held on June 18th, reported that all the manufacturing shops could now be considered as having been practically reconstructed, the equipment had been improved and augmented, and the productive capacity was substantially greater than in 1913. So far the company had not suffered from the industrial crisis, although the volume of new business being booked was diminishing in the case of electrical plant of low capacity, while the orders for large machines would ensure activity for a long time forward. As net profits the accounts for 1920 show a total of 4,619,000 fr., permitting of the payment of a net dividend of 25.25 fr. per registered share, 18.70 fr. per bearer share, 13.50 fr. per partly-paid share, and 38.80 fr. per profit share. At the conclusion of the ordinary proceedings a special meeting was held, when it was decided to amalgamate the company with the Forges et Ateliers de la Longueville under the title of the Forges et Ateliers de Constructions Electriques de Jeumont, with a share capital of 80,000,000 fr.

German Companies.

The Land und Seekabel Werke A.G., of Cologne-Nippes, which has a paid ordinary share capital of 7,500,000 marks, reports that the works was satisfactorily employed in 1920, and orders have also been favourable in the new financial year. The net profits amounted to 2,700,000 marks, as against 1,040,000 marks in 1919, and the dividend is increased from 15 per cent. in the latter year to 20 per cent. for 1920.

The A.E.G.-Schnellbahn, A.G., of Berlin, the construction of whose high-speed railway is being delayed owing to the cost of construction and disputes with the municipal authorities, has ceased paying interest on the shares during building as the guarantee expired in 1919. On the other hand, the A.E.G. is paying 50 marks per share on the preference shares for 1920.

The C. Lorenz A.G., of Berlin, after writing off 2,709,000 marks for depreciation in 1920, as against 1,151,000 marks in 1919, reports net profits of 2,742,000 marks, as compared with 1,568,000 marks. It is proposed to pay a dividend and bonus of 35 per cent., as contrasted with 20 per cent. in 1919, and to increase the share capital from 10,125,000 to 20,250,000 marks.

The report of the *Elektrizitats A.G. vorm. Lahmeyer & Co.*, of Frankfort-on-Main, dealing with the year 1920-21, states that the electricity supply industry was able to resume and continue satisfactory development, although the profits realised were not high, having regard to the depreciation of currency and the extraordinary expenditure for maintenance, renewals, and new works. On the other hand, the situation of the tramways was substantially more unfavourable than the supply works, most of them yielded no profits, and it was at present doubtful whether any change in this direction would take place in the future. The accounts show net profits and balance forward amounting to 4,388,000 marks, as compared with 3,015,000 marks in 1919-20, and the dividend is at the rate of 10 per cent. on share capital of 40,000,000 marks, this contrasting with 8 per cent. in the previous year. It is proposed to increase the capital to 60,000,000 marks in order to finance new undertakings and provide for the future needs of subsidiary companies.

The directors of *Felten & Guilleaume Carlswerk A.G.*, of Cologne and Mulheim, state that in general 1920 was a quiet year. The scarcity of coal, specially in the first quarter, prejudiced the company, as it prevented all departments from being kept in full operation so that it was impossible to meet the market requirements. Quantitatively the production was about half of that turned out in 1913, the reduction being due to the manufacture of more highly finished products, but more particularly to the shorter working shift and the decreased hourly efficiency, which represented 86 per cent. of the efficiency in 1913. The number of workmen employed averaged 5,763, and had thus reached the pre-war level. After setting aside 1,106,000 marks for depreciation, as against 1,418,000 marks in 1919, the accounts record net profits of 25,992,000 marks, as compared with 10,139,000 marks, and the dividend is increased from 15 per cent. in 1919 to 20 per cent. last year. At the recent general meeting it was stated that with an increased turnover of 30 per cent. in the five months ended with May, 1921, the invoice values were about the same as in the corresponding period of last year. The degree of activity in telephone and telegraph cables was satisfactory, but was less so in heavy cables.

Canadian General Electric Co., Ltd.—Dividend of 20 per cent. on the common stock.

Nairobi Electric Power & Lighting Co., Ltd.—Interim dividend of 5 per cent. for the year ended December, 1921.

Stock Exchange Notices.—Application has been made to the committee to allow the following to be officially quoted:—

Hadfields, Ltd.—£1,000,000 7½ per cent. 10-year first mortgage debenture stock.

Mississippi River Power Co.—71,179 6 per cent. preferred shares of $100 each, fully paid (stamped); and 8,128 6 per cent. preferred shares of $100 each, fully paid (unstamped).

The undermentioned have been ordered to be officially quoted:—

Mather & Platt.—313,660 ordinary shares of £1 each, fully paid (Nos. 1,050,001 to 1,363,660).

Mississippi River Power Co.—71,179 6 per cent. preferred shares of $100 each, fully paid (stamped).

Shanghai Electric Construction Co.—4,510 shares of £10 each, fully paid (Nos. 32,001 to 36,510).

Shawinigan Water & Power Co.—90,000 shares of $100 each, fully paid.

Westinghouse Brake & Saxby Signal Co.—£350,000 8 per cent. first mortgage debentures (Nos. 1 to 200, £500), (201 to 1,700, £100), and (1,701 to 3,700, £50), (registered).

Brazilian Traction, Light & Power Co.—Revenue received under contracts with subsidiary companies for 1920 totalled $7,036,824, plus interest on investments and miscellaneous income $206,618, together $7,243,443, less general and legal expenses, administration charges and depreciation on securities $313,782, interest and charges on secured gold notes and other loans $674,537, provision for general amortisation $260,000, leaving net revenue $5,995,122. Dividends on preference shares at 6 per cent. per annum absorb $600,000, leaving surplus of $5,395,122, plus $2,587,008 brought forward, making $7,982,131. Approximately $4,900,000 has been utilised towards meeting capital expenditure on properties, leaving $3,082,131 to be carried forward. The board are much disappointed that they have been unable to authorise resumption of payment of dividends on ordinary share capital. This has been due to extremely unfavourable exchange conditions which have prevailed and still continue, and stringency of money which has made it impracticable to finance necessary capital expenditure by sale of securities.—*Financial Times.*

Calcutta Tramways Co., Ltd.—Revenue for 1920, including interest on investments and deposits, less tax, £222,121, plus £55,959 brought forward, making £278,080, less debenture stock interest £15,750. Preference share dividend £12,500, interim dividend on ordinary shares, free of tax, £24,081; E.P.D. for 1919 £36,672, leaving £189,075. The directors propose to pay a final dividend of 3s. 6d. per share, making 7 per cent., free of tax, placing to reserve for depreciation £40,000, to taxation reserve £80,000, to staff provident fund £2,402, carrying forward, subject to Indian super tax, £42,391. Reserve for depreciation now stands at £144,619. Owing to the increase in salaries and wages made in 1920, the full effect of which will not be felt until the current year, it has been necessary to consider the adoption of a scheme for a higher scale of fares which, however, has not yet been brought into operation.

Crompton & Co., Ltd.—The net profit for the year ended March 31st, 1921, after providing for depreciation, interest on debentures, directors' fees, &c., and a reserve estimated to cover E.P.D., Corporation Profits Tax and Income Tax for the year, is £66,292, plus £18,177 brought forward, making £84,468. There is to be put to general reserve fund (making it £75,000) £19,500; 10 per cent. is paid on the preference shares for the year, and a dividend of 10 per cent. per annum on the ordinary shares (£32,677), leaving £18,370 to be carried forward. In order to cover the abnormal fall in prices of material, an exceptionally large sum has been written off stocks. Annual meeting July 14th.

New Issues.—*North Metropolitan Electric Power Supply Co.*—The list was to close to-day (Friday) in an issue of £228,460 7½ per cent. debenture stock at 95 per cent., the proceeds of which will be applied to the discharge of outstanding loans from the bankers and the general development of the company's business. The list, however, was closed within an hour or two of opening on Monday morning, but country applications were being considered up to the following morning.

Horseley Bridge & Engineering Co., Ltd.—The result of trading for the year ended March, 1921, is considered satisfactory. Additions and improvements to the buildings and plant have been made out of the proceeds of the new capital, and they are now thoroughly modern and efficient. Dividend 8 per cent., free of tax, for the year; £10,000 to reserve; carried forward £12,385.

Provincial Tramways Co.—Owing to the industrial unrest, increased wages, and the coal strike, the directors are unable to recommend an interim dividend on the ordinary shares in respect of the year ending September 30th, 1921.

General Electric Co., Ltd.—Profit for year ended March, 1921, £796,149, against £630,143 for previous year. Dividend for the year 10 per cent., free of tax, on the increased ordinary capital. £348,094 carried forward.

Anglo-American Telegraph Co., Ltd.—Dividends of 15s. per cent. on the ordinary and 30s. per cent. on the preference stock, less tax, for the quarter ended June.

Companies struck off the Register.—The following companies have been struck off the register, and are dissolved:—
Carbonoid, Ltd.
Colston Electrical Works, Ltd.
Globe Associated Cable & Telegraphic Services, Ltd.
Stolz Electrophone Co. (1913), Ltd.

Taunton Electric Traction Co., Ltd.—Receipts for 1920, including £214 brought forward, £5,478; after deducting all expenses and debenture interest, £611 is carried forward.

Marshall, Sons & Co., Ltd.—Dividend of 5 per cent., less tax, on the ordinary shares for the year. £65,499 carried forward.

National Electric Supply Co., Ltd.—Interim dividend 2s. 6d. per share, less tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

THE resumption this week of work by the miners has given the Stock Exchange more hopefulness if not a greater volume of business. The markets for industrial shares are generally better. There was a scramble for the underwriting of the North Metropolitan Electric Power debenture stock, and the issue is said to have been stagged fairly extensively. Some of those who applied for the 7 per cent. Extension debenture stock recently issued by the Metropolitan Electric Co.—the price is 5 premium—are said to have been selling this in order to exchange into the new North Metropolitan 7½ per cent. debenture stock offered at 95. The amount is the comparatively small total of £228,460, and the subscription-lists were open for less than two hours. General Electric new debenture has improved to 23s. 4d. discount, and the other recent new issues in the electrical world are very steady. The new form of Government borrowing came rather as a surprise.

Siemens 10 per cent. preference remain at 22s., but the ordinary rose to 22s. 6d. Mond Nickel 8 per cent. debentures are 5 premium, City of London Electric new ordinary stand at 23s., and the new preference at 21s. 6d., while Central Electric Notes, which came out at 97, are now 102. The effect of the 6 per cent. Bank Rate is beginning to make itself more felt, and now that the half-year has turned, people with money on deposit at the bank are asking whether it is worth their while to keep their capital in the banks at 4 per cent. when they can get 7 per cent. on a first-class security.

The railway market is better, the steam stocks recovering on a mere modicum of investment buying, while the Undergrounds have continued to improve, with Central Londons still to the fore, at rising prices.

Prices of cable shares show a disposition to weaken. This is so much of a change from the usual conditions in the market that it is worth noticing by those who have been on the look-out for an opportunity to buy such sound investments as the Eastern group, for instance, is able to offer, provided the prices are reasonable. Westerns are 5s. down, Eastern ordinary has lost 2 points, Globes are 16¾ ex dividend, while Eastern Extensions remain unchanged at 16½. It is said that a certain amount of "dead" stock has recently come in, and that this is the reason for the unusual appearance of dulness which overspreads the list. If either of the stocks in this quartette go back to the level 16 (equal to 160 for Eastern Telegraph ordinary), it will be worth picking up by those who value security and six per cent., free of tax, on their money.

Everybody is asking what prospect there may be of the Income Tax coming down in the next Budget, and the general view carries little consolation to the Income Tax-payer. This is in itself an indirect factor for keeping prices good in such cases as those where the dividends are paid free of tax. Anglo-American deferred is ¼ lower at 16¾, following its fall of 15s. last week. Indo-Europeans have not recovered from their £5 drop. Shares changes hands at 26 early in the present week. West India & Panama have fallen still further to 6s. 3d., on the disastrous report, while the first and second preferences are still quiet about 50s. The last recorded transaction in the first preference took place on May 3rd at that price, but no business has been marked in the second preference since the middle of August, 1920, when shares changed hands at £4.

The protest raised against the sending out by the London & Suburban Traction Co. of an invitation to tender, together with a letter stating that the last recorded transaction in the Stock Exchange took place at 61, whereas the present price is 66-70, elicited an apology from the Company, together with a notification giving the current quoted price. As it is at this time of the year that companies are apt to invite these applications for tender of stock from proprietors, it may be worth while to repeat that the safest course for the stockholder to pursue is to inquire of his stockbroker what is the market position. Experience goes to show that the stockholder need not be afraid of putting a tolerably high price on his tender if he wishes to sell, though there is, of course, no obligation for him to part with the stock. If the company does not buy the stock at the price proposed by the stockholder, the latter is left with his security, and is in none the worse position. It may be doubted whether the system is a good one, though candour will compel the admission that any other procedure which may be adopted will be found to have its disadvantages.

The foreign group is irregular. Brazilian Tractions fell again, but rallied sharply. The recent report, however, has disappointed those holders who looked for early resumption of the quarterly dividends of 1 per cent. Of such resumption there seems to be little immediate probability, and it is obvious that Brazil is passing through a difficult time. The 6 per cent. preference shares are changing hands fairly freely on the basis of 74½. British Columbia Electric Railway stocks show good rises. The Mayor of Vancouver, who has been over here on a visit, did no little good by his frank exposition of the manner in which points of friction which have hitherto arisen, between this side and the other, can be negotiated by the exercise of a little goodwill on the part of the British board of directors and the customers in Vancouver. His remarks as to the steady prosperity of the municipality and of the province have encouraged fresh confidence in the minds of those financially interested. Mexicans are inclined to be heavy, owing to the non-arrival of the coupon-money which some had expected would be paid on July 1st in respect of the Mexican Government 5 per cent. Loan. This has disturbed various Mexican prices, although those in the utility group show no quotable changes. The Argentine list is steady. Anglo-Argentine first preference are now quoted ex the dividend of 3s. 9d. per share due at the end of last month.

Electricity supply shares are unchanged, beyond the recovery of the dividend on Metropolitan preference. English Electrics are sixpence harder, and General Electrics 7½d. lower. Henley's and Callender's have come together at the common price of 28s. 9d. Engineering issues keep steady, and the armament group is a little better, on the end of the coal strike. Rubber shares are the turn harder in consequence of a trifling rally in the price of the produce.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price July 5, 1921.	Rise or fall.	Yield. £ s. d. p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	8¾	—	10 6 6
do. do. do. 4½ Pref.	4½	4½	8	—	7 10 6
Chelsea	4	6	8½	—	9 4 8
City of London	13	14	1/-	—	11 16 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 9
County of London	6	6	8½	—	9 17 0
do. do. 6 per cent. Pref.	6	6	8¾	—	7 7 8
Kensington Ordinary	7	9	4¾	—	10 18 9
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2⅞	—	10 18 9
Metropolitan	6	7	8½	—	10 0 0
do. 4½ per cent. Pref.	4½	4½	2⅝xd	+ ⅛	7 13 9
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	2½	—	9 9 10
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	6½	—	9 10 6
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	83½	—	7 3 9
do. Def.	1½	1½	16⅜	— ⅛	9 1 10
Chile Telephone	6	6	5	—	6 0 0
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16½	—	6 1 3
Eastern Tel. Ord.	10	10	164½	−2	6 1 7
Globe Tel. and T. Ord.	10	10	16⅝xd	—	6 3 2
do. do. Pref.	6	6	9¼xd	—	6 11 6
Great Northern Tel.	22	24	25½	—	8 11 6
Indo-European	10	10	20	—	8 6 8
Marconi	25	—	2⅝	— ⅛	—
Oriental Telephone Ord.	12	12	2⅜	— ⅛	*5 16 8
United R. Plate Tel.	6	6	5⅞	+ ⅛	*7 2 8
West India and Panama	Nil	Nil	6/3	— ⅛	Nil.
Western Telegraph	10	10	16⅝	— ¼	*6 2 2
HOME RAILS.					
Central London Ord. Assented	4	4	69½	+1	5 1
Metropolitan	1½	1½	26	+ ½	5 15 5
do. District	Nil	Nil	18	—	Nil
Underground Electric Ordinary	Nil	Nil	9⅞	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	4	2	81½	−1	2 9 4
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	89xd	+ ⅛	10 0 0
do. do. 2nd Pref.	Nil	6½	24	—	9 11 4
do. do. 5 % Deb.	5	5	68½	—	7 12 8
Brazil Tractions	Nil	Nil	32	+1	Nil
British Columbia Elec. Ry. Pfce.	5	5	67½	+1½	8 18 10
do. do. Preferred	5	4⅓	86½	+3	*8 9 0
do. do. Deferred	3	6	55½	+4	*10 18 2
do. do. Deb.	4½	4½	60½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	12½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	23½	—	Nil
Mexican Light Common	Nil	Nil	11½	—	Nil
do. Pref.	Nil	Nil	18½	—	Nil
do. 1st Bonds	Nil	Nil	70½	—	Nil
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	23	—	6 14 6
British Aluminium Ord.	10	10	15/9	—	12 14 0
British Insulated Ord.	15	—	14xd	—	9 19 0
Callenders	15	15	28xd	—	10 8 6
do. 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	16/9	—	12 6
Edison-Swan	10	—	11/8	—	—
do. do. 5 per cent. Deb.	5	5	68xd	—	7 7 1
Electric Construction	10	10	16/9	—	12 6 3
English Electric	8	8	12/6	+6d.	12 16 0
Do. Pref.	6	6	15/-	—	8 0 0
Gen. Elec. Pref.	6½	6½	15⅝xd	—	8 2 6
do. Ord.	10	10	1½	— ⅛	*9 13 8
Henley	15	15	1	+ ⅛	10 8 8
do. 4½ Pref.	4½	4½	8¾	—	6 18 6
India-Rubber	10	—	1⅛	—	—
Met.-Vickers Pref.	8	8	1⅛	—	8 16 10
Siemens Ord.	10	10	1½	+ ⅛	*8 17 10
Telegraph Con.	20	20	20½	—	*6 17 0

* Dividends paid free of Income Tax.

THE NEW OPPORTUNITY FOR BRITISH FIRMS IN THE CANADIAN ELECTRICAL MARKET.

[Communicated]

The Emergency Tariff of the United States has now gone into effect, and British firms could do much worse —now that the coal strike has been settled—than to study the possible results of that measure upon the prospects open to them for developing business in the Dominion in competition with American manufacturers at present holding such a large proportion of that valuable market. For some time past, of course, the British sovereign has been depreciated in Canada, and this depreciation in sterling has, coupled with the tariff preference, been a considerable incentive to exporters in the United Kingdom. At the same time, the Canadian dollar has undergone a corresponding depreciation when purchasing goods from the United States, and wholesalers in the Dominion have experienced endless annoyance and difficulty in connection with the financing of purchases south of the international boundary line.

As the result, however, of the exchange situation between Canada and the United States, the Canadian producer of grain, livestock, dairy produce and other natural products—disappointed with the prospects in the British market owing to the cessation of Government buying last autumn—marketed great quantities of his produce in the United States, so much to the alarm of the American farmer that influence has been brought to bear on Congress resulting in the imposition of such heavy duties on Canadian farm products that a trade worth about $160,000,000 a year is almost certain to be entirely killed. The obvious result of this manœuvre on behalf of the agriculturists of the United States must be to increase the sale of Canadian agricultural produce in the United Kingdom, further encouraged by the reversal of the British Government's agricultural policy, and a resultant further discount on sterling funds when eastward shipments are resumed next Fall; and a heavy drop in the value of Canadian funds in the United States, vastly increasing the existing difficulties experienced in purchasing American goods. The decision of the Canadian authorities to assess duties on American goods at the face value in the United States of the consignments *plus the exchange margin* increases the burden carried by American exporters immediately by 15 per cent. of the duties payable, and will operate during the next few months—as exchange rates tend to fluctuate still further against him—as an almost insuperable bar to sales of goods which can be obtained from Canadian or from British manufacturers. British manufacturers of electrical goods should therefore make every effort to meet the demand of Canadian importers seeking alternative supplies, and from the statistics quoted below, it will be seen that, although the market is largely supplied by the domestic manufacturers, there is still a considerable trade to be secured by exporters here who can seize the opportunity in time. Canadian imports of electrical goods during the fiscal year ended March 31st last amounted in value to $16,918,568, and of this trade the United States secured $16,095,283, leaving only $572,673 for British imports of every description of electrical apparatus. No reliable information is available regarding home production in the boom period of 1920, but during 1919 Canadian manufacturers produced electrical apparatus worth $34,187,658, exports amounting to only $651,461 last year, and to $424,476 in 1919-20. The Canadian market for electrical goods is therefore worth in the neighbourhood of twelve million pounds sterling, with a prospective expansion during the next few years to a very much higher total, in view of the phenomenal development of hydro-electric energy in the Dominion, amounting already to between two and three million horse-power. Last year there was in process of installation in the Dominion some 650,000 h.p., about half a million horse-power being in Ontario alone, and with the prospective completion of the Queenston-Chippawa power canal and the coming into operation of the first sets at the new Niagara power station, a great increase in the use of power by industrialists, farmers, railways, and other consumers is to be expected.

Taking the Canadian imports of electrical goods seriatim, we find that during the twelve months ended March 31st, 1921, the Dominion bought from abroad electric primary batteries worth $64,783, in addition to 89,341 electric storage batteries valued at $1,364,456, practically all from the United States. The domestic production was worth, according to the 1919 figures, $1,767,094 for primary batteries, and there was an output of $561,974 worth of storage batteries. Imports of dynamos and generators reached last year $1,323,604 (only $93,766 from this country), the Canadian production in 1919 amounting to $1,804,687. Electricity meters worth $24,620 came from the United Kingdom, and imports from south of the international boundary reached $352,348, the domestic production of meters not being stated in the returns. Canada imported electric light fixtures and metal parts thereof worth $668,475 and manufactured herself (1919) goods worth $1,248,640. Imports of electric arc lamps amounted to $28,742, and of electric incandescent lamps there were imported from the United Kingdom 52,045 lamps worth $8,952; from the United States, 3,372,608 worth $970,163; from Japan, 777,207 worth $58,770; from the Netherlands 832,590 worth $141,536; and from other countries, 13,019 worth $5,083; a total of 5,047,469 lamps valued in all at $1,184,504, as compared with the domestic output (1919) of 7,971,105 lamps worth $2,424,720. Imports of electric cooking and heating apparatus amounted to $129,575, compared with a domestic production worth $1,009,353 in 1919. Electric motors worth $2,628,734 were imported last year, this figure being greatly in excess of the 1919 domestic production amounting to $1,629,823 (representing 4,076 motors). Imports of sockets reached $304,160, the 1919 domestic production being $769,382. Telegraph instruments and wireless apparatus were imported to the total of $121,298 home production reaching only $15,677; the corresponding figures for telephone apparatus being respectively $922,357 and $1,835,979. Imports of transformers amounted to $167,427, home production to $1,502,261, and the returns included electric apparatus, not otherwise provided for, totalling $7,633,425; the domestic production (1919) of which $1,011,837 was for switchboards, panel boards, and cabinets; carbons, $1,243,631; insulated wires and cables, $8,536,126; electric irons and fans $453,085; fuses, $313,550; and other electrical apparatus and supplies $5,009,514, apart from parts of dynamos, generators, motors, batteries, &c., worth altogether $636,963. The Canadian electric apparatus industry comprises 95 works capitalised in 1919 at $45,956,399, and employing then 9,560 persons, at wages or salaries amounting to $9,685,705, the industry being centred almost entirely in Ontario and Quebec.

Electrified Sugar Mill. — The new sugar mill of the Su'a Sugar Co., at La Lima, Honduras, will be the largest electrified sugar mill in Central America. Power will be developed by a 1,000-kW turbo-generator set with an auxiliary set of 200-kW for lighting and general purposes. The United States Consul reports that all the electrical equipment will be furnished by an American company and installation will be made by the same American company as is constructing the mill. The fuel to be used for running this system is cane fodder and scraps.

THE OUTLOOK IN THE NEAR EAST.

Market Conditions in Greece and Egypt.

Greece.

No hope of an early revival in the Greek market can be drawn from a general survey of conditions there. In fact the prospects of developing business lie in the distant future. Such is the only conclusion that can be reached after a study of a report by H.M. Commercial Secretary at Athens, which has recently been issued by the Department of Overseas Trade (H.M. Stationery Office, price 1s. 9d.). Since the report was penned events of a political nature have further postponed the recovery which the British manufacturer would like to see. Depreciated exchange is the main difficulty. The Commercial Secretary shows how this has been a contributory cause of the accumulation of stocks, including, amongst general merchandise, gas engines. Should the political situation be cleared up, he says, local currency will immediately improve in value. In the meantime, the market is gradually becoming depleted of stocks, and when the exchange again becomes more or less stable, there should be a renewed demand for British goods.

Foreign Competition.

The general position in Greece, while reacting unfavourably on British trade, has to a large extent given German and Austrian goods the needed opportunity of recovering their former influence in the market. Very considerable quantities of German goods are now in Greece, and continue to arrive by every steamer. In view of the low quotation of the German mark, German manufacturers are in a position to supply their products to Greece at prices ranging from 40 to 60 per cent. cheaper than those of British manufacturers. The principal products arriving are chemicals and drugs, which are re-establishing their former position in the market; engines (Diesel, semi-Diesel, gas, and oil), motor cars, small machines, ice-making machines, pumps, tools, hardware, paper, pianos, leather goods, &c.

Local opinion attributes the difficulties in the way of developing British trade, first, to the great rise in the exchange value of the £; secondly, to the fact that British manufacturers and firms do not send their wares on consignment basis even to first-rate firms in the country, and they give no facilities in general as to payment, while German manufacturers and firms do; thirdly, to the fact that the British never, or rarely, send travellers round the principal towns, and do not advertise to any extent in the local Press or otherwise, important points never neglected by the Germans.

It can hardly be doubted, however, that there is still a strong local predilection for British goods and British agents, and that, given anything like a return to normal industrial conditions at home and normal financial relations between the two countries, British trade would have little to fear from competition from whatever quarter it came.

Engineering Developments.

The Electric Co. of Volo, which bought up the Electric & Gas Co. some years ago, since when, for reasons connected with the war, gas has no longer been produced, has been preparing to supply it again from the existing plant. It was expected to be available, for houses already possessing installations, by April, and owing to the inferiority and high price of charcoal will be extensively used for cooking purposes. Were it not for the present rate of exchange, there should be, in this connection, a good demand for British cooking and other domestic appliances.

Messrs. M. C. Stamatopoulos Fils are engaged in various engineering activities, including electric lighting at Trikkala and Karditza. They are also undertaking for next year the lighting, by hydro-electric power, of Makrynitza. This firm has offices at Athens and other centres.

Before the war Patras was lighted by gas, and a tramway service, with electric power, linked up the town. Both these concerns belonged to the Société Thomson-Houston of Athens. They were discontinued during the war, and have not since been resumed, negotiations between the company and the municipal council for a resumption having failed. Electric lighting for the town is supplied by a private concern. The light is poor and costly and the installation crude.

A company was formed in 1919 to utilise the water power of the river Glaucus which falls into the plain of Patras at a distance of some five miles from the town. Surveyors have estimated that sufficient power could be obtained for the whole of the electric supply of the town, *i.e.*, lighting, power to the various works, and for the running of the tramways. The proposals of the company are being considered by the Government.

The report contains some indications regarding methods of business, terms of payment and the appointment of agents and commercial travellers. These will repay study against the time when operations in the Greek market may be profitably resumed.

Egypt.

Little encouragement to cultivate the Egyptian market is contained in the recent report of H.M. Commercial Agent at Cairo (H.M. Stationery Office, price 1s.).

He records the series of crises through which the country passed last year, resulting in a complete reversal of the exceptionally favourable trade balance of 1919, and summarises as follows the disabilities under which import trade is suffering:—

(1) The enormous stocks held in the Egyptian bonded warehouses; (2) the present shortage of ready money due to the cotton crisis; (3) the number of small local manufacturers of various classes of goods which sprang into being during the war and are now, naturally, competing with United Kingdom products; and (4) the increase in the number of firms of doubtful character which is the usual aftermath of war.

Complaints with regard to the high prices demanded for machinery by the British exporters, whose goods are admitted to be the best on the market, are made on every possible occasion, and in the majority of cases it is the cheapest price that is preferred to superior quality of material, sometimes even in the case of Egyptian Government contracts. Large orders for railway material and rolling stock, steel work, dynamos, &c., have thus gone to foreign firms because the British quotations have been too high, added to the fact that the date of guaranteed delivery was not satisfactory.

Return of the Teuton.

It is unfortunate that, owing to German firms being able to accept such very low prices, they have succeeded in wresting fairly large contracts from United Kingdom exporters for railway material required by the Egyptian State Railways, and other kinds of material and plant required by other Government Departments; *e.g.*, light railway permanent way for use in connection with oil workings by the Department of Mines on the Sinai Coast. Unless British steel firms are prepared to make a big sacrifice, in spite of prices at present ruling in Sheffield, and to guarantee within a specified period, in order to keep their hold on the market for Egyptian Government contracts, they must not be surprised to see all future orders secured by German, Austrian, or Belgian firms, particularly for railway material and rolling stock.

German ("Bosche") dynamos have been arriving in great numbers and were quickly sold owing to the low price demanded, and also to the fact that either United Kingdom exporters had apparently overlooked the Egyptian market for some months, or had not delivered them in sufficient quantities for its needs, as British dynamos appear to be very scarce at present.

Quantities of German fittings and spare parts are returning to this market.

As in pre-war days, the Germans are pinning their faith to advertising efficiency, a steady flow of propaganda, both printed and verbal, and the excellent quality of their samples. The rate of exchange is so much in their favour as regards competition abroad that they are now in a position to undersell both the United Kingdom and other Allied and neutral countries in most manufactured articles.

It is to be regretted that the efforts of the British Chamber of Commerce to hold a trade exhibition and create a permanent sample room of British goods should so far have met with failure owing to lack of support from the United Kingdom. There is no gainsaying the value, from the point of view of advertisement and commercial propaganda, of enabling native and European buyers, particularly the former, to see the actual article with their own eyes, instead of being left to form vague and often erroneous impressions about it from a catalogue, which may not even be in a language they understand.

Advertising and Commercial Propaganda.

Failing a trade exhibition, there is a good deal to be said for advertisement in the Press and elsewhere, and for commercial propaganda by films as well as by the more ordinary media such as trade journals, articles in the local European and native Press, monthly or quarterly booklets, &c.

Advertising is done extensively by means of drop-curtains at theatres and kinema houses, and of programmes, &c., and it is to be regretted that very little advertisement is done in this way by United Kingdom firms, in view of the extent to which it is used by German, French, Italian, and Greek firms.

The kinematograph appeals to all nationalities, and is very popular with the natives, and it is to be hoped that United Kingdom manufacturers will make the most of the medium now employed by one enterprising local firm for advertising its goods, viz., short and amusing films thrown on the screen during the half-time interval or between two long films.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New London Showroom.

The Sloan Electrical Co., Ltd., has recently opened a fittings showroom in newly acquired premises adjoining its London office in Golden Lane. The room is designed with oak panels, green ribbed canvas wallpaper, and polished parquet flooring with a few Oriental rugs, the furniture being of the Jacobean period. The accompanying illustration will convey some idea of the artistic taste displayed in designing the showroom. The firm has been appointed agent in London, the South Coast, and the East Coast of Scotland by Messrs. Peyton & Peyton, Ltd., of Birmingham, manufacturers of decorative electrical fittings and art metal work. This firm has had a wide and varied experience in the design and manufacture of fittings for theatres, kinemas, and public buildings, having recently equipped the Futurists' Theatre, Birmingham, and the Manor Park Kinema. In addition to this class of work it manufactures a comprehensive range of fittings for ordinary domestic lighting, comprising many exclusive and new designs in dining and dressing room pendants, indirect lighting bowls, and other items. The fittings are well lacquered to withstand the various climatic and atmospheric conditions met with. All the classic styles and periods such as Louis XIII, Louis XIV, Adam, Empire, Georgian, &c., are represented, as well as a choice selection of bronze figures and porcelain table standards.

Fig. 1.—The Sloan Electric Showroom.

In the showroom is also a full range of heating and cooking apparatus of the "Slonetric" type, in addition to vacuum cleaners and other labour-saving devices, ready wired for demonstration and display.

In our issue of June 10th (p. 764) we described the "Philips" night lamp, of the neon gas type, which has been placed on the market by the Sloan Electrical Co., Ltd. We have obtained from that firm the accompanying illustration (fig. 2) showing the construction of the lamp—two helical electrodes, without any metallic connection between them.

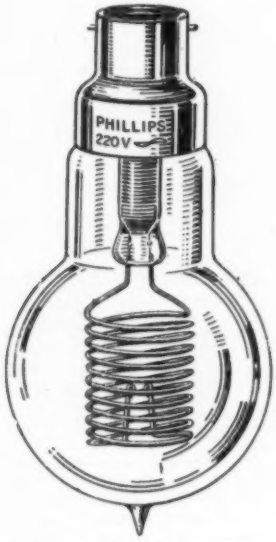

Fig. 2.—The "Philips" Night-lamp.

New Switch-Fuses.

Mr. J. B. Rudkin, of 212a, Shaftesbury Avenue, W.C.2, has enabled us to inspect some switch-fuse gear made by his principals, Messrs. Sprecher & Schuh, of Aarau, Switzerland.

The fuse shown in fig. 3 consists of a stationary part and a removable carrier. The stationary part is designed for fixing to central iron or tubular framework. The contacts are carried on porcelain insulators, the latter being fixed to a cast-iron base. The contact pieces are fixed mechanically to the supporting insulator, which in its turn is also held by suitable clamps in the cast-iron base. All cementing, which so often gives rise to disturbances in the service and supply of power, has been carefully avoided. This mechanical fixing of all parts enables rapid exchange of porcelains, or any other details to be made. The contacts are composed of copper clips fixed in brass sockets, and are also supplied with bolts for switchboard mounting. These parts are massive, and have a dull nickel finish. The fuse carrier consists of a tubular handle with suitable detachable hand-shields, and is made of a tough, non-combustible, and arc-resisting material. This material, under ordinary working conditions, is indestructible, wilful damage excepted. The fuse strip is made of zinc, which combines the advantages of low melting temperature and minimum explosive effect. These fuses are made in sizes up to and including 600 amps. normal current capacity.

For larger currents, Messrs. Sprecher & Schuh manufacture a horn-type fuse. This apparatus consists of a movable arm, which at its upper end carries a horn-shaped sparking tip. The main fuse strips are carried by substantial contact pieces below the horn-gap. The movable arm is held in its closed position by means of a second fuse strip of small capacity, which is connected in parallel to the main strips. The switch-arm having a tendency to fall to its lower position, will keep this auxiliary strip under a mechanical strain. When the fuse blows, the main fuse strips will melt through, throwing the entire load on to the auxiliary strip, which will rapidly melt through, releasing the switch-arm, which will fall to its open position. During this action the arc set up by this auxiliary strip will be taken up by the horn-shaped spark tips, and it will be rapidly extinguished owing to the breaking distance being thus rapidly increased. These fuses are particularly designed for very heavy currents, and are made in sizes up to 8,000 amps. Mr. Rudkin claims that they fulfil all the requirements set out by "A Central-Station Engineer" in his article "Fuses in Sub-stations" (Elec. Rev., April 15th, 1921, p. 468).

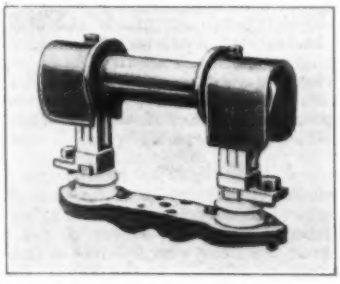

Fig. 3.—Medium-pressure Switch-fuse.

"Lamlok" Sealed Locking Ring.

As new needs arise, new devices are produced to cope with them, and Messrs. "Lamlok," Ltd., of 36, Rusthall Avenue, Chiswick, W.4, who have demonstrated their fertility of resource on previous occasions, have again had occasion to solve a problem. The rapid development of electricity supply to small houses for lighting at a fixed charge per lamp per week or per quarter, in connection with housing schemes, has drawn attention to the necessity of a device which will not only prevent a customer with lax views on morality from replacing the lamps originally installed with lamps of higher wattage—a function efficiently performed by the ordinary "Lamlok"

locking ring—but will also enable an inspector to ascertain at a glance whether the lock has been tampered with, for the ingenuity of the unmoral is notorious, and if a consumer by some means gains possession of a key, he can change the lamps and lock them again, leaving no obvious indication of the substitution.

To meet this case, the firm has made a slightly modified ring which, at a trifling increase of cost, provides an effective check. Instead of the ordinary round boss on the ring, a

Fig. 4.—"Lamlok" Locking Ring with Provision for Sealing.

square boss is used, through which holes are drilled for the insertion of a wire to which a lead seal can be attached. So long as the seal and wire are intact, which can be readily verified by the inspector, it is certain that the original lamp is still in place. The sealing ring is illustrated in fig. 4.

THE NATIONAL PHYSICAL LABORATORY.

Annual Visitation.

The annual visit to the National Physical Laboratory of the members of the general board took place on June 28th, when a large number of guests was invited, who were received by Prof. C. S. Sherrington, president of the Royal Society, the chairman of the board, and by the director of the Laboratory, Sir Joseph Petavel.

An interesting ceremony preceded the visit, when a bas-relief in bronze of the late director, Sir Richard Glazebrook, was presented to the Laboratory. The presentation was made by Sir Joseph Thomson, Master of Trinity College, Cambridge, and was received on behalf of the Laboratory by Prof. Sherrington. The bas-relief is the gift of a large number of friends of the late director, including many past and present members of the general board, and has been placed in the hall of the administration building. The artist is Mr. J. Cluysenaar, of Brussels, who has produced a most successful and striking likeness of Sir Richard Glazebrook.

It is now over 18 months since Sir Richard was succeeded by Sir Joseph Petavel, who has carried on very actively the work of his predecessor. Building operations are still in progress at Teddington, indicating that the work of the Laboratory continues to increase in magnitude and importance, and the Admiralty has erected a research laboratory within the N.P.L. grounds, so that much of its special work may be carried on in close co-operation with the N.P.L.

All departments of the Laboratory were on view, and many interesting experiments were performed and apparatus demonstrated in the various departments.

Annual Report for 1920.

The report of the Executive Committee for 1920 refers to the continued growth of the activities of the Laboratory which will render further extensions necessary in the near future.

During the year the fees charged for testing have been completely revised in relation to the increased cost of the work. The number of optical and electrical instruments sent for test is appreciably less than before the war, but there is a tendency towards recovery. The number of tests in radiology decreased by 75 to 17; tests of electrical measuring instruments decreased by 228 to 473; in electrotechnics a decrease of 4,494 to 2,134 tests is shown; and in photometry a decrease of 4,382 to 1,275. On the other hand, the total number of tests increased by 353,558 to 1,656,872 during the year. The following are abstracts of the several sections of the report:—

Physics Department.—Radiology.—Radium preparations have been standardised by comparison with the British radium standard, which contains the equivalent of about 30 milligrammes of hydrated radium bromide, but is not very suitable for the standardisation of amounts of the order of a milligramme. About four years ago a small subsidiary standard was procured, and since that date small amounts have been standardised by comparison with it. To obviate the use of the British radium standard as a working standard two additional subsidiary standards were purchased this year, containing respectively about 10 and 13.5 milligrammes of very pure hydrated radium bromide. By using these standards in conjunction with the ultimate standard, single quantities of radium up to at least 120 milligrammes of hydrated bromide can be tested with accuracy at the Laboratory.

The two γ-ray methods of standardisation at present in use at the Laboratory are the Rutherford direct method and the Rutherford and Chadwick balance method. The four standards have recently been thoroughly intercompared by these two methods. They were grouped together so as to give nine different combinations, and the value of each ratio agreed by the two methods to within about 0.5 per cent. A third γ-ray method, due to Madame Curie, is to be added to those already in use. In this case the radium is placed on top of a large circular plate condenser, consisting of two sheets of lead about 80 cms. in diameter and 5 mm. in thickness. An insulated aluminium plate situated between the lead plates with a clearance of about 2 mm. on either side serves as the electrode. The ionisation current produced is balanced by means of a quartz piezo-electrique. The relative saturation currents produced by the test and standard preparations afford a definite measure of the quantity of radium present.

Some work has been done on the estimation of the radium content of luminous compounds. Several modifications were made in the method of procedure, and investigation showed that the absorption coefficient was the same before and after mixing the radium with the sulphide. In addition to zinc sulphide other salts were examined, the values of the absorption of radiation in which will be useful in a number of directions. An investigation is at present being undertaken in conjunction with the electrotechnics department on various points connected with the production of luminous compounds. The Laboratory is co-operating in this work with the British Scientific Instruments Research Association.

A research on the absorption and scattering of penetrating γ-radiation from radium C in different metals has yielded interesting results. The apparatus employed for this work is entirely different from that used for the absorption of γ-rays in salts. In the case of aluminium, zinc, tin and lead, a selective or "fluorescent" absorption was observed. Both the "forward" and the "backward" scattering coefficients were also measured. The latter is difficult to measure, even with this improved method, which was made sensitive by the use of a special ionisation chamber and a tilted gold-leaf electroscope. The value of the total scattering coefficient of γ-radiation in light substances is comparatively high, so that it is important to take scattering into account in radium measurements. A light object, such as a wall, is a powerful scatterer of γ-radiation, and for this reason apparatus for standardising radium should, whenever possible, be situated in the middle of the room, so that the intensity of the scattered radiation from the walls should be reduced to a minimum in the neighbourhood of the measuring apparatus.

The examination of materials by X-rays is now carried out on a routine basis.

The X-ray spectrometer for the measurement of the absorption qualities of materials used for protective purposes in radiography is nearing completion. The instrument, which reads to 5 seconds of arc, is designed so that a portion of the beam reflected at the crystal face may be used as a standard of reference whilst the remaining portion is used for the measurement of the absorption, so that errors due to the variable output of the bulb will be eliminated. A battery of X-ray tubes is being obtained for use with the instrument. These will have anticathodes of palladium, rhodium, silver, copper, nickel, platinum, and tungsten, and will supply a number of standard wave-lengths which will be employed for standardising purposes.

The method of measuring the intensity of an X-ray beam depending upon the change of colour of barium platinocyanide pastilles produced by the rays has been thoroughly examined and a number of useful results have been obtained. The dose of X-rays measured by the pastille has been compared with the ionisation produced in a gold-leaf electroscope placed in a fixed position relative to the bulb. The following quantities have been varied, and the effect of these variations on the time of dose as measured by the pastille has been studied: (1) Voltage on the tube, (2) current through the tube, (3) rate of interruption of primary current of the induction coil, (4) length of time of "make" of primary current, (5) type of interrupter. The pastille used throughout was the original Sabouraud pastille. The investigation is now being extended to pastilles supplied by other makers.

The thermometry division had for some time been exercised as to the degree of vacuum prevailing in the bulb of the solar radiation thermometer which the Laboratory uses as a standard. Any method involving the opening of the bulb would result in a dislocation of continuity in the measurements made in the test work. The radiology division thought that the only safe method was that of the electrodeless discharge. Acordingly a bulb of the same dimensions as that of the thermometer was constructed and an electrodeless discharge was passed simultaneously through the two bulbs. The experimental bulb was connected to a Gaede pump and a pressure gauge capable of reading pressures to the nearest 0.02 mm. The two bulbs were placed side by side and the pressure in the one altered until the colour of the discharge through it matched that through the bulb of the radiation thermometer. The mean of a number of readings of the pressure in the experimental bulb when the colours of the discharges were

the same gave an approximate value of the pressure inside the thermometer bulb. Another inquiry on much the same lines came from the electrotechnics department. In this instance the approximate pressure was required inside the bulbs of certain electric lamps which formed the subject of a particular investigation. An estimate of the pressure was made along similar lines to that described above, and a simple piece of apparatus to accommodate any shape of bulb has been constructed which will facilitate the carrying out of this test in future.

Oscillograph records of the secondary potential of an induction coil, taken with the Taylor Jones oscillograph, proved useful in explaining certain discrepancies which arose during the course of the investigation on the measurement of intensity of X-rays. An improved design of ordinary gold-leaf electroscope has been put into use. The insulation of the gold-leaf system has been effected by means of an ebonite plug into which a broad sulphur ring is fitted. In an instrument having a leaf about 4.5 cm. long, the end of the leaf falls through 0.11 mm. in an hour when its initial potential is 280 volts, and a change of potential of 1 volt on the leaf moves it through 0.51 mm. It has kept at this rate of natural leak and sensitivity for over four months and has worked throughout that period satisfactorily. The chief feature of the instrument is the arrangement for charging the leaf system, which is undoubtedly superior to that previously employed. A number of tilted gold-leaf electroscopes to new designs have been constructed.

The War Office X-ray laboratory developed during the war a method of testing the definition of X-ray tubes which were classified as having fine, medium, or broad focus. The test can now be carried out at the Laboratory by means of a simple apparatus which has been constructed for the purpose.

The observation that different types of mercury arc varied greatly in their suitability for interference work led to an investigation into the causes of these variations. As a result a lamp was designed to strike the best compromise, for general interference work, between the mutually incompatible properties of high intrinsic brightness and homogeneity of the spectral lines. A lamp to this design has been constructed and found very satisfactory. Its intrinsic brightness lies between that of the ordinary laboratory quartz arc, in which the spectrum lines are much broadened, and that of the ordinary long tubular glass arc used for workshop lighting, which gives fairly homogeneous lines, but is not bright enough for some purposes, while its homogeneity is similar to that of the latter.

(To be continued.)

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(Continued from page 10.)

On Wednesday morning, June 29th, Mr. FLADGATE'S cross-examination was resumed.

In reply to Mr. Paddon, who asked whether he would have any objection to the Port of London Authority having direct representation upon the joint body under the companies' scheme, Mr. FLADGATE said he regarded them as large consumers, and they might come in under that category. He would, however, raise no objection to their direct representation.

In reply to Mr. Tyler, witness said he would be extremely glad if the railway companies were represented. Their coming in would react on the success of the scheme. He could not go into the question of the representation of the railway companies, however, until the railway companies had decided what they really wanted. If they were represented on the Joint Board they would be useful, in that they and the other undertakers would render mutual assistance to each other, but apart from that he did not think the railway companies would do the scheme any good.

Mr. Morse questioned the right of an electric lighting authority to lease any part of its undertaking to the Joint Authority under existing statutes, and contended that this could not be done unless express powers were obtained. Witness, however, said there was nothing to prevent a company leasing a generating station.

It was pointed out that Clause 22, Sub-section 1, of the 1919 Act, would probably meet that point.

With regard to administrative expenses, assuming there was no revenue in the early part of the scheme, witness said these would have to be met out of capital. With regard to the suggestion in the scheme that the Joint Authority might get a grant from the Exchequer, witness said he did not expect this, but would get it if possible.

The CHAIRMAN said he understood that the revenue would come from the nucleus companies and local authority undertakers which it was hoped would join together to form a working body.

Mr. FLADGATE at this point left the inquiry owing to urgent business. His cross-examination will be resumed later.

Sir ALEXANDER KENNEDY (executive engineer to the London Electricity Joint Committee (1920), Ltd.) then gave evidence, and corroborated the statement made by Mr. Kennedy in his opening speech. Speaking with regard to the area proposed under the present scheme, he said that rather to his surprise it was found that practically the whole of the demand within the area provisionally delimited by the Commissioners came within the smaller area defined by the companies. It was not only desirable, but essential, that the greatest possible number of undertakers should come into the scheme under some joint technical control if the highest degree of efficiency was to be obtained. It was the opinion of the engineers that that control should be very complete. The difference between generating costs in the existing stations when enlarged and improved and the cost of energy generated and transmitted from capital stations was not now nearly so much as it would have been a few years ago. In the past economy in some London stations had left much to be desired, but the additional 250,000 kW of plant which the Commissioners had recently sanctioned was to be plant which would ensure the highest degree of economy. As to the capital expenditure, he and Mr. Partridge had worked out some supplementary particulars based on assumed reductions in cost of plant, rate of interest, &c. They had assumed that the rate of interest would be reduced from 6½ per cent. to 5 per cent., the cost of extra plant would be reduced by 30 per cent., coal to 25s. per ton, and other costs reduced by 25 per cent. On these assumptions, the new capital required, for the first stage, instead of being £1,050,000, would be reduced to £948,000, and the new capital in the second stage would be reduced from £8,450,000 to £7,115,000. It would be more advantageous to develop existing organisations for the time being under central control than to put down capital stations at once. The conclusion he drew from the figures was that when the time came for the erection of the capital stations he did not think it would be desirable to spend £5,000,000 on existing stations, as the difference between the cost of enlarging the existing stations and of erecting capital stations would be so small.

In answer to the chairman, Sir ALEXANDER said that the action of the Commissioners in authorising the erection of additional plant with a capacity of 250,000 kW by existing London undertakings, had made it unnecessary at present to erect new capital stations.

The CHAIRMAN said the Commissioners had sanctioned that additional plant because the undertakings concerned would not have been able to meet their statutory obligations otherwise.

Continuing, Sir ALEXANDER KENNEDY referred to the engineers' estimates of future demands. The increase for the six years following the year 1919 was based on an increase of 26,000 kW per annum, which was 26 per cent. more than the maximum obtained during the previous six years. For the next five years they had assumed an increase of 36,000 kW per annum. With regard to grouping and interconnecting, they had endeavoured to provide for an increase of load where this would occur. It would probably be six or seven years before the capital stations would be necessary. In three or four years the capital stations would probably have to be designed and their erection decided upon, and at that time those responsible would have a much better chance of seeing what the future demand was likely to be. If after four years the engineer to the Joint Authority had made up his mind that the capital station would be required in another three years, he would still have, under the estimates set out in the supplementary particulars, a sufficient margin of reserve plant to carry him on for those three years. As to the railway companies, in the technical scheme provision had been included for the electrification of the South Eastern, Great Eastern, and Brighton Railways. The South-Western and North-Western Railways proposed to meet their own demands by extending their existing works. There were other railways which had no intention of electrifying their systems. Afterwards it was found that the Great Eastern and Brighton Railways were putting forward proposals to the Commissioners. The Great Eastern Railway had a particularly advantageous site of its own for the generation of electricity, and had expressed its willingness to sell any surplus electricity generated to the Joint Authority. The Great Eastern, North-Western, and South-Western had allowed him to say that under proper arrangements they would be quite willing to supply surplus electricity, if desired.

He had prepared a diagram of the diversity factor which would be obtained if all the London undertakers, both local authorities and companies, the tramways, and the railways, were worked from one single station. The engineers had been given the maximum demand on two winter days by all the London undertakers. They had tabulated those hour by hour, and added together the total demand at each hour, and had separately added up the maxima at each particular undertaking which occurred at different hours. The result was that, taking the aggregate instantaneous demand, this was 319,000 kW, and the aggregate sum of the maxima was 344,000 kW, the ratio between those being 1.07. His interpretation of that was that if the whole of these companies and local authorities, including tramways and railways, were all worked from one station, the difference between the sum of the maxima and the actual instantaneous maximum would be 7 per cent. Without the railways the instantaneous maximum would be 214,000 kW, and the sum of the maxima, 222,700 kW. The ratio between them was 1.04, and 1.07

with the railways, so that, taking the winter load, the difference was only 3 per cent. That 3 per cent. would be swallowed up by a number of other considerations.

Mr. TURNER, cross-examining on behalf of the Conference of Local Authorities, referred to the question of control. Under the companies' scheme it was proposed that there should be complete control, whereas under the local authorities' scheme there would be some measure of control, but not complete control. In the companies' scheme only those undertakers who agreed would be controlled. Assuming that only the nine companies which constituted the Joint Committee came into the scheme, which would be more likely to improve the supply? The nine companies under complete control, or the whole of the undertakers in the area under the measure of control suggested in the local authorities' scheme?

WITNESS said that if only nine companies came in they must be taken as a nucleus of a much larger authority.

Further discussion on the point of the degree of control to be exercised by the Joint Authority, as provided for by the two schemes, was terminated by an intimation from the chairman that this was a matter which could be dealt with by counsel in their closing observations.

Mr. TURNER then dealt with Clause 24 of the companies' scheme, which provided that when the generating station and main transmission lines of an undertaker were leased to the Joint Authority, the latter body should supply to the undertaker energy to meet his statutory obligations at a price at which the equivalent price per unit sent out should not be greater than the cost at which the undertaker would have been able to generate and send out if the lease had not taken place. In addition, Clause 34 provided that the prices charged by the Joint Authority should be fixed with a view to securing that the receipts therefrom would meet the liabilities on revenue account and provide a reserve fund for depreciation and renewal of plant, &c. Mr. Turner suggested that there would be no funds available when the Joint Authority came to apply to Clause 34.

The CHAIRMAN said that Clause 24 referred to the cost of energy at the undertaker's existing stations, and as soon as the maximum loads were reached, the obligation imposed under that clause, as he understood it, would cease in respect of supplementary units. It was unreasonable to expect any new authority to undertake for all time and under all circumstances to supply at prices which were possible with plant at pre-war prices. If the plant had to be extended at present-day prices, the costs would go up.

Mr. KENNEDY said the intention of the clause was as expressed by the chairman.

The CHAIRMAN pointed out that the whole object of the scheme was to provide electrical energy more cheaply than it could be supplied under existing conditions, and instanced the case of the Central Co., and its arrangement to supply to the Westminster and Pall Mall Co., which was an example of what it was hoped to bring about under the proposed scheme.

The economy to be effected by the operations of the Joint Authority was further discussed, the conclusion of Sir ALEXANDER KENNEDY being that a substantial saving would be effected. The extent of this saving could only be ascertained by an investigation into every one of the present undertakers' accounts.

Mr. RIDER and Mr. WORDINGHAM here said they were unable to give any figures in this connection, but Mr. DONALD, for the Poplar scheme, said he would be able to give actual figures when his scheme was dealt with.

Mr. DONALD, cross-examining, asked a number of questions with regard to the effect of the rental clause in the present scheme on the figures submitted in the supplementary particulars, and the extent to which that clause modified the figures. Sir Alexander, however, could not deal with this point, which, it was pointed out, Mr. Fladgate had said would be dealt with by the engineering witnesses. In the end it was agreed that if Mr. Fladgate could not deal with the point on Thursday the promoters would bring forward another witness to deal with it.

Sir HERBERT NIELD, on behalf of the Surrey County Council, suggested that the companies should confine their area on the north and south to the London County area, so that Surrey could bring up its own scheme to deal with the county. The South-Western and Brighton railways had generating stations in the county, and the South-Western Railway was willing to consider the installation of additional plant at its station in order to help with the supply so long as this did not interfere with its own railway supply. Supposing terms could be arranged with the railway companies in the reasonably near future, would it not be reasonable to ask that the whole of the county of Surrey should be left out of the present scheme, so that the county could bring up its own scheme? Sir ALEXANDER replied that if such a scheme could be brought up there might be something to be said for it.

In reply to Mr. Tyler, WITNESS said the load factors taken by him for traction were, for the L.C.C. tramways, 47.46, Lots Road, 47.4, North-Western Railway, 34.01, Metropolitan, 32, Great Western, 43.8, and he put it at an average of 40 per cent. He admitted that the load factor would be improved by goods traffic, a good deal of which was worked during the night, but he did not think the diversity factor would be very much affected.

The inquiry then adjourned until Thursday.

Mr. FLADGATE was recalled towards the end of the Thursday morning session for further cross-examination, Sir Alexander Kennedy's cross-examination having been concluded without throwing much fresh light on the question.

Mr. DONALD, for the East London scheme, questioned Mr. Fladgate at length on the supplementary particulars of the nine companies, with a view to showing that the finance of the proposal was unsound. The point was that under the revised scheme, with the smaller area, the financial position could be changed, and counsel wished to get at the exact quantity of the change.

Mr. FLADGATE found himself unable to answer, and it was left to the financial expert who is to be called.

Sir JOHN SNELL said that if it was intended by the scheme that the rent of 7 per cent. on the cost of the plant less depreciation should continue for 60 years, it might be that it would have to be paid long after the life of the plant in the station at the time of the acquisition. Therefore, the Joint Authority would be paying upon plant which it did not have the use of.

Sir HARRY HAWARD, on the other hand, said the position was that the rental of 7 per cent. was in lieu of a lump sum, and it did not matter over what period the rental was paid. At the same time he said none of the tables in any of the three schemes showed precisely what the financial position of the Joint Authority as a separate entity would be.

Mr. DONALD said the effect of the rental scheme for acquiring the generating stations had not been taken into account in the tables in the scheme, because this method of acquisition was not before the engineers when they drew up the technical scheme upon which the finances were based.

Answering Mr. Baker, for the North Metropolitan Electric Power Co., Mr. FLADGATE said he personally saw no reason why the power areas of the North Metropolitan and Metropolitan Co.'s should not be excluded from the area, because it was hoped to make satisfactory arrangements with the power companies.

Mr. BAKER said that was precisely the North Metropolitan Power Co.'s position and, moreover, there was already the necessary statutory provisions to enable that to be done. He asked for the exclusion of the whole of the company's power area, as well as the Willesden power station, which was not in the Power Co.'s power area.

Mr. HENDERSON, for the L.C.C., said he was anxious to understand the legal questions involved in the proposed leasing or hire purchase scheme. A company had no powers to transfer its generating station without a special order or an Act of Parliament.

WITNESS said he was not divesting himself of any of his powers. He was only transferring his plant, and could erect a station elsewhere.

Sir JOHN SNELL suggested that the point might be met by the last words of Section 14 of the Act of 1919, which said a company could divest itself of its powers by a Special Order or Act of Parliament. The Commissioners could make the Special Order in setting up the Joint Authority.

Mr. HENDERSON said it depended on the true interpretation of the words in question. Did it mean that where a company was constituted by a Special Order, such a lease could only be granted by a Special Order, and where a company was constituted by an Act of Parliament any transfer of the powers must be by Act of Parliament. His point was that there was a doubt whether the Commissioners had any powers to authorise companies to lease their stations, without there being special statutory authority to do so.

Mr. KENNEDY, for the companies, said he agreed there might be legal difficulties, but they could be got over.

Mr. HENDERSON said that under the L.C.C. scheme there was only an acquisition of the generating stations for which there existed statutory powers, but there were no statutory powers authorising a lease in the way suggested in the scheme.

Mr. FLADGATE said that if such a proposal could be carried through, it would save a very great deal of movement of money. If the scheme was so good in its merits that the Commissioners recommended it for acceptance, whatever difficulties there might be he could not imagine Parliament would not grant the necessary permission. It would certainly be necessary, in his opinion, to go to Parliament for permission to extend the tenure of the distributors and the powers to lease the generating stations could be dealt with at the same time.

At the conclusion of his cross-examination, Mr. FLADGATE was questioned by the Commissioners. Asked by Sir Harry Haward why the constitution of the Joint Authority set out in the original scheme had been abandoned, Mr. Fladgate said that gave representation to authorised distributors, because they were authorised distributors, but the revised scheme only gave representation to those authorities which were financially or in some other way interested in the Joint Authority.

Sir HARRY HAWARD said that on the system of representation now suggested, the Joint Authority might consist of 84 members if the Commissioners' area were taken or 62 if the companies' area was taken, and that would make a very large body.

Mr. FLADGATE said that was the reason why it was proposed to delegate the work to the Technical and Finance Committees and no doubt others would be appointed. He considered 29 or 31 working members as in the case of the L.C.C.

scheme, and even in that case there would have to be committees. If the general body of members was increased, and the work done by committees, he considered there would be greater efficiency, because of the greater choice. Even 20 or 25 members as working members of an authority such as this was too large if any practical work was to be done.

Sir Harry Haward said that as he saw the matter at present, the introduction of the financial qualification for membership of the Joint Authority would create considerable complication.

Mr. Fladgate said the object of the scheme was to get something done soon. For that purpose, the Joint Electricity Authority required stations and money. The hope was that the local authorities would come in, and that the Companies would find the money necessary for the first few years, and in that event he felt a great deal would have been achieved for the benefit of London. It was the first step which was important, and when that first step was taken, the rest would follow, and the Electricity Authority would be handed over an undertaking which could be developed on the right lines.

Discussing labour representation on the Joint Authority, Mr. Fladgate said he had no objection, but he did not think for practical purposes it would be of any advantage. Payment of the chairman of the Finance and Technical Committees was touched upon by Sir Harry Haward, who suggested that this was not necessary, but Mr. Fladgate thought the duties would be very onerous, and should be paid for.

Answering further questions, Mr. Fladgate agreed this was a private company enterprise scheme, and the companies were prepared to find £1,200,000 necessary for the initial stage. That was, he contended, evidence of the *bona-fides* of the companies. So far as capital was concerned, he agreed that in existing circumstances there would be a difference of at least 1 per cent. in favour of the L.C.C. over a Joint Authority without the security of the rates. Unless the Joint Authority had complete control of the generating stations in some form, he believed it would be absolutely impossible to effect any improvement in the present conditions.

Sir Harry Haward compared the proposal of the companies as regarded purchase with that of the L.C.C., and pointed out that the L.C.C. scheme did not propose to take over obsolete plant, whereas the companies did.

Mr. Fladgate said the L.C.C. suggestion would have the effect of the stations being acquired at different periods, which would be most unsatisfactory. He would prefer that the companies should hand over their generating stations in, say, three or four years, which would give the Joint Authority an opportunity of doing the important work of linking-up, the companies being meanwhile under the control of the Joint Authority.

The term of years for extension of the distributing rights was next discussed. Sir Harry Haward pointed out that whereas the L.C.C. did not propose any term of years, the companies now proposed that the period should be 50 years from 1931. Mr. Fladgate said that somewhat similar terms were proposed by the L.C.C. in its Bill of 1914, but that was a proposal to form a new operating company which should have a concession for 50 years.

Mr. Henderson said it would have to be a matter of bargaining between the L.C.C. and the companies.

As to the mode of payment, Mr. Fladgate said he had no objection to the L.C.C.'s paying off the capital sum by giving notice instead of paying 7 per cent. for the whole period. Personally, he felt that 6 per cent. might be a sufficient sum for the rental figure.

Sir Harry Haward appeared to think that the purchasing authority should have the right of paying off the cost of the generating stations and mains if it desired, and witness saw no objection.

Mr. Page referred to the representation on the Joint Authority, and Mr. Fladgate said the intention was that authorities giving financial assistance should have a greater representation, by increasing the financial assistance given, than an authorised distributor entering into an agreement to take a supply from the Joint Authority. The latter could only have one vote in any event, whereas the former would have one vote for every £100,000 subscribed or guaranteed.

On Friday, July 1st, Mr. G. W. Partridge (Chief Engineer to the London Electric Supply Corporation) gave evidence in support of the Companies' scheme. He referred particularly to an arrangement which had been made with the Governor of the Gas Light & Coke Co. with regard to leasing part of that company's site at Beckton. The advantages which would accrue from generating electricity on this site would result in effecting large economies. Arrangements had been made with the Gas Light & Coke Co. to lease part of its site to the Joint Authority for 99 years—although, of course, a binding agreement had not been entered into. The site would accommodate a generating station with a capacity up to 200,000 kW. It was not proposed to erect the station all at once, but in sections, as the demand grew.

Dealing with the advantages of such an arrangement, Mr. Partridge said that in the first place the cost of fuel would be largely reduced, owing to the large quantity of coke and coke breeze available on the site. This would be burned in boilers specially designed for the purpose, and there was no difficulty in burning it. There would also be a great saving in capital outlay, because of the existing wharves, piers, railway sidings, &c., which were available, and the fact that the river would not need to be dredged. There were three means of getting fuel. The first was the coke breeze and coke from the gas works; secondly, the coal required for the generating station would be handled by the existing piers and other facilities; and thirdly, the coal contractors had an unloading jetty immediately alongside of the site, so that colliers could be unloaded, and special railway sidings or transporters would be installed connected directly to the power station. The contractors had facilities, he believed, for unloading about 5,000 tons of coal on one tide. The Gas Light & Coke Co. was handling about 2 million tons of coal per annum at this site, and the additional coal required for the generating station would not be a very great amount. There would also be no difficulty in housing the employés of the power station, and there were tramway and railway facilities. The joint working of the two companies could be a further advantage in connection with the utilisation of coal. If any further improvements were made in the carbonisation of coal, or if the utilisation of waste heat or by-products became practicable and economical in the future, such improvements could be utilised for the mutual benefit of the two companies. Again, there was an advantage due to the close proximity of the northern outfall sewer, which would be of great value in connection with the laying of transmission lines, and would save a considerable amount of money in the re-opening and repair of public streets.

Mr. Partridge added that Sir Alexander Kennedy, Mr. Rider, and Mr. Wordingham thoroughly endorsed all he had to say in this matter.

Cross-examined by Mr. Donald, for the Poplar scheme, witness said the saving in connection with the provision of jetties would be approximately anything from £300,000 to £400,000 in capital cost.

Mr. Page, one of the Commissioners, pointed out that the electricity authority would have to pay for the use of the jetties.

Mr. Partridge agreed. Continuing, he said that the figure he had mentioned would include the cost of dredging the river, and the erection of piers, railway sidings, gantries, &c., for a 100,000-kW station. The figure was a conservative one. He could not estimate the annual saving which would be effected by the use of the special facilities at the Beckton site, but it would be considerable. The saving with regard to the disposal of ash would also be considerable.

Mr. Donald then dealt with the three capital stations which it was proposed to erect in the eastern part of the area under the scheme, and suggested that these were too near each other. Also two of the sites were chosen primarily in order to deal with the railway load. Mr. Partridge said the particular sites were chosen because the densest part of the load was in that district. In addition to the railway load, there was also the load on the south side of the river, which would be dealt with by the suggested capital station on the south side. Mr. Donald pointed out that by putting the stations lower down the river, out of the London area, there would be a saving in rates.

Sir Harry Haward referred to the difficulty of holding possible sites for, say, seven years, because it was not proposed to build capital stations until then, and it was a difficult thing to hold options over sites which would not be required for seven years.

Mr. Partridge said he thought the Governor of the Gas Light & Coke Co. would be prepared to leave the matter over.

Sir Harry Haward expressed some doubt as to the advantage of erecting a costly generating station on a leasehold site, but Mr. Partridge said he thought there was no disadvantage in doing this.

Continuing, Sir Harry said that if the station were erected and the plant installed by the Joint Electricity Authority, they would probably have paid off the whole of the loan raised for that purpose in, say, 60 years. What was to be the position for the remainder of the lease? Surely it would be impossible to put in new plant if the whole building were to become the property of the Gas Light & Coke Co. in the end? Mr. Partridge said that the saving effected by using the Beckton site would be such that in his opinion it would be worth while erecting the station. Moreover, he should imagine that in 60 years gas and electricity would, at any rate, be produced by entirely different methods. In reply to a further question by Sir Harry, witness said there were some London stations erected on leasehold lands.

Replying to Mr. Page, Mr. Partridge said the electricity authority would pay for the privilege of using the various facilities already existing at the Beckton site, but he did not anticipate that this would amount to very much. The amount saved on fuel would depend on the cost of coke. The average cost of the coke would be slightly less than that of coal, but the cost of the breeze would only be half that of coal. They would not get the same efficiency in burning breeze as with coal. He had burned a great deal of breeze, and although there had been a certain amount of trouble, he was burning it very efficiently to-day.

In reply to Mr. Lackie, one of the Commissioners, Mr. Partridge said the coal storage would be independent, and there would be room for about 30,000 tons.

Mr. D. Milne Watson, Governor of the Gas Light & Coke Co., was then called, and said he had had many interviews with Sir Alexander Kennedy and Mr. Partridge, two of the engineers for this scheme, with regard to the erection of a

power station on the Gas Co.'s site at Beckton, and the site had been gone over with the Gas Co.'s engineers, with a view to seeing if an acceptable arrangement was possible. Personally, he considered it would be very advantageous from the point of view of his company and the supply of electricity for the reasons which had been outlined by Mr. Partridge. He would be prepared to advise his Board, if a satisfactory arrangement could be come to, to grant a lease to the London Electricity Joint Committee (1920), Ltd., for 99 years for the purpose of erecting an electric power house and working in conjunction with the gas company. Such a lease would not require statutory authority.

Sir HERBERT NIELD, who appears for the Hertfordshire County Council in opposition to the electrical schemes, asked if Mr. Milne Watson had not some apprehensions as to what might happen to him if he got into such close contact with an electrical neighbour. Mr. MILNE WATSON said he had none whatever.

Sir HERBERT NIELD: I should have thought it was a case of the young lady who went for a ride on the tiger.

Mr. MILNE WATSON: It depends on who is the tiger.

Sir HARRY HAWARD (one of the Commissioners) raised the question of preserving the buildings and plant for the lessees at the end of the term, supposing them to have a value.

Mr. MILNE WATSON said it would all depend on the terms of the lease. If the Gas Co. was going to lose the right to take over the plant at the end of the lease, it would be necessary for the terms to be different from what they otherwise would be.

Mr. BOOTH (one of the Commissioners), taking up the point dealt with by Sir Herbert Nield, said he had heard Mr. Watson give evidence on another occasion to the effect that he had satisfied himself that the time had come when the cut-throat policy as between gas and electricity supply had gone. He imagined Mr. Watson was of opinion that there was no reason why the gas and electrical industries should not work side by side, and that the field was big enough for both of them.

Mr. MILNE WATSON agreed, and said that such a scheme as this would be in the national interest. Indeed, it would be in the national interest to bring both industries together generally. The gas companies had a large amount of solid fuel which had to be disposed of, and if it could be disposed of close at hand it was better for both parties; it saved the transport and possible double handling of large quantities of bulky solid fuel. It was not a question of one swallowing the other, but of their helping each other.

Answering Mr. Page, Mr. WATSON said there was always a surplus of coke available. A good deal of it was exported at present, and there would be no difficulty in always having sufficient for an electricity generating station.

Sir JOHN SNELL (chairman) said he gathered that there would be no difficulty, in Mr. Watson's view, in the electricity works having the use of the coaling facilities at Beckton, and that such use would not interfere with the gasworks.

Mr. WATSON said arrangements could easily be made for taking fuel in without interference with the gasworks. Coke could be taken direct from the gasworks retorts into the other works.

Sir JOHN SNELL said he presumed that the Gas Light and Coke Co., with its great organisation, was watching the question of improved methods of carbonisation, and if any process of low-temperature carbonisation became practicable it would be possible for the gas company to carry it out.

Mr. MILNE WATSON replied that that was so, and if such a development did take place, an electric power station was one of the best means for utilising the gas so produced.

Mr. W. A. PEARMAN, secretary to the Westminster Electric Supply Co., was next called, and handed in a table dealing with the proposal by which the Joint Authority will purchase the generating stations of the companies and local authorities. Great difficulty was experienced in understanding the purport of it, and it was arranged that Mr. Pearman should be called at a later stage to be cross-examined with regard to it. Mr. Pearman's explanation may be summarised as follows: The Joint Electricity Authority should purchase the generating stations and transmission mains on the basis of cost less depreciation, either by payment of a lump sum or in the form of a rental calculated on the basis of 7 per cent. per annum of the ascertained value, plus a sinking fund to wipe out the capital cost at the end of a period corresponding with the termination of the companies' extended tenure as distributors, say, 50 years from 1931. According to the calculations the value of the plant to be purchased in the area taken by the companies' scheme, is at present 10.6 millions sterling, this figure including companies and local authorities. In 1931, the value would be reduced to 4.775 millions sterling.

Sir HARRY HAWARD said it was quite impossible to judge the effect of the proposal unless the companies' undertakings were kept separate from the local authorities, and Mr. Pearman agreed to bring up further statistics on these lines.

Mr. ARTHUR COLLINS, city treasurer of Birmingham, was then called as the financial witness for the Conference of Local Authorities' scheme, he having been prevented by illness from attending when this scheme was previously before the Commissioners. He put it that the Joint Authority should be able to raise money at 6¼ per cent. without the security of the rates, because of the guaranteed income it would have. This should be 2 per cent. better than the railways would be able to raise money at for erecting generating stations. At the beginning, the Joint Electricity Authority would not need to raise much money, and he strongly urged that the Commissioners should recommend the Treasury to assist in the early period with a loan. Under the Act of 1919, the Treasury could advance money to the Ministry of Transport for the erection of generating stations, and he should think the Joint Authority could be assisted in this way. It was true that such loans to the Ministry of Transport could only be for a period of two years, but under the No. 2 Electricity Bill it was proposed to increase that period to five years, and that should be sufficient for the early needs of the Joint Authority. With regard to meeting the administrative expenses of the Joint Authority, as a result of the evidence given to the Commissioners, he was of the opinion that these expenses should be met by the distributors who took supply, in proportion to the units taken, by the authorised distributors who did not take supply, in a smaller ratio, and on some basis by the other authorities, so that all parties concerned contributed. He put such contributions to the administrative expenses on the same basis as a subscription to the I.M.E.A. or the Municipal Tramways Association, or the Association of Municipal Corporations, in that the Joint Authority would have in its charge the general good of the electricity supply in the whole area. The terms of purchase of the local authorities' undertakings should be either the transference of the stations with outstanding debts or the payment of capital cost less depreciation, whichever was the greater.

Answering Mr. Henderson, for the L.C.C., Mr. COLLINS said that authority should pay a substantial share of the administrative expenses of the Joint Authority.

On Tuesday, July 5th, Mr. COLLINS was cross-examined by Mr. Donald on the estimates of the scheme, and admitted that the figures concerning the Conference scheme did not give any estimate of the cost of electricity at any particular stage of the undertaking.

Sir JOHN SNELL put a number of questions on this point, and suggested that it would have been an advantage to have had figures of this character. It rather seemed that the promoters had not given consideration to the matter, yet it was a most important one.

Mr. COLLINS said that although he had put in similar figures in other inquiries held by the Commissioners, and the terms of the Commissioners' notice with regard to the present inquiry called for such figures, he must frankly say that in the case of London the conditions were such that it was impossible to put forward such figures.

Counsel then asked questions about the proposed purchase terms in the companies' scheme. Mr. COLLINS said that although this was not his proposal, he was willing to discuss it. After a great deal of argument, it was again made clear by Mr. Kennedy that the companies wanted the cost of the plant paid either as a capital sum or by instalments in the form of a rental.

Sir JOHN SNELL asked if it were the intention of the Companies that the amount paid to them should not be greater than the interest and sinking fund charges payable on the debt. If that were so, it was a simple issue which he could understand.

Mr. SYDNEY MORSE, for the County of London and other companies, said he did not understand the proposal in that way.

Sir HARRY HAWARD said he thought the position was clear so far as the Companies were concerned, if they wanted a certain sum either as a lump sum or in instalments. The position, however, was different from the point of view of the Joint Electricity Authority, because if the amount was paid by instalments over, say, 50 or 60 years, it would happen that some of the plant, if not all the plant, would be worn out before the instalments to the Companies were paid, and it would not do to have another loan running while the instalments were unfinished.

Eventually, it was agreed that the financial experts should confer and try and arrive at a definite scheme for the purchase of the generating stations and transmission mains, in order that it could be seen in figures exactly what the financial result would be. As drawn, the scheme was ambiguous, as already pointed out.

Mr. HENDERSON, for the L.C.C., said that if the statement of the companies' position made by Sir Harry Haward was accepted, it would remove many of his objections.

Mr. KENNEDY said that at the moment he thought that statement did explain the position, but he would like an opportunity of consulting with his clients, and the Companies would also be very willing for their financial experts to consult with the experts of the L.C.C. on the point.

Discussion of the question was therefore postponed until such a conference was held. Cross-examination of Mr. Collins, on other matters, however, proceeded.

Sir HERBERT NIELD, for the Hertfordshire County Council, sought to get an expression of opinion from witness that such a scheme should be confined to, say, country areas, and that therefore the present scheme should be restricted to London.

Mr. COLLINS said his opinion would not be worth anything. The area must be left to the Commissioners, and he had sufficient faith in the people behind the Conference scheme to

believe that they would make a success of it even if the area was larger than the County of London. As to representation, it might be for the benefit of the scheme that there should be direct county representation. As for counties and other authorities paying a share of the administrative expenses of the Joint Authority, Mr. Collins said that it must be regarded as an insurance for the protection of the general interests affecting electricity supply. It was necessary to take a broad view of a matter of this kind, and certainly in the case of representation there should be contribution to the administrative expenses, notwithstanding that some portions of the counties so represented and contributing might get no immediate benefit from the scheme. As a rough figure, the authorities which did not take a supply would only have to pay, say, £10 a year, whilst in the case of a county the contribution should be round about £100. He could not, however, agree to a proposal made by Mr. Wrottesley, for the Middlesex County Council, that county councils should have a minimum representation without contribution, leaving them to subscribe if they pleased and have larger representation in proportion to the financial assistance offered voluntarily.

Discussing charges, Mr. Collins said he favoured the zone system of charging because the area was too large for a flat-rate charge. It might be possible to apply the principle of charging the cost of the main to supply a certain district to that district, and in that way the zonal system might be avoided. This had been done in connection with other power schemes, but in the case of the London area delimited by the Commissioners it was so large that this principle might not be applicable.

Breaking into his cross-examination, Mr. Collins said a broad view must be taken. In placing schemes before Parliament for the development of areas, for administrative purposes, such as town planning, it was the custom to look 50 years ahead, and to look even 20 years ahead was not taking the long view. In his opinion the most practical people were those who looked furthest ahead.

During some questions as to the administrative expenses of the Joint Authority, Sir Harry Haward pointed out that the only expenses would be that portion of the total not properly chargeable to capital or to the consumers taking supply. Thus there would only be a balance to be provided for.

Mr. Collins said he doubted whether the total would be much more than £10,000.

Sir John Snell said it would be an advantage if the Commissioners could have a precise statement showing the total administrative expenses and the amount that would have to be found by those bodies not taking a supply.

Mr. Turner promised that this should be done.

Mr. Collins, in the course of further questions, said he regarded the Joint Electricity Authority as a conciliatory body between authorised distributors, such as the North Metropolitan Power Co., and the local authorities. The Joint Electricity Authority would have a great influence in preventing litigation and inducing the small local bodies to take the long view in regard to electricity. In that way, a great deal of expense would be saved in litigation which now took place. That was an important instance of the advantage to be gained if all the authorised distributors should come into the scheme, and he personally felt that it was a wrong policy for the North Metropolitan Power Co. and the Metropolitan Electric Supply Co. to ask to be left out of the scheme.

Later, Mr. Collins said that sooner or later all Joint Electricity Authorities would have to go to Parliament to clothe themselves with the powers necessary to carry on their undertakings.

At this point further cross-examination of Mr. Collins was postponed until after the result of the conferences which are being held by the financial experts is known.

Mr. Donald then outlined the East London and District scheme, prefacing his remarks by pointing out certain modifications in the scheme as originally deposited with the Commissioners. These are dealt with as the scheme is described below. The general proposals for the supply of electricity in East London would, said Mr. Donald, have been more or less gathered from his cross-examination. Briefly, the case was that where there was an industrial area sufficiently large to absorb the output of its own plant, such an area should be recognised as an independent area. In putting forward the East London scheme, however, he did not ask that that area should be cut off from electrical communication with the outside areas. He did ask, however, for financial autonomy. Moreover, it might be necessary that there should be some central authority to control a large area containing, say, 5 or 6 areas of the nature of the East London scheme, and no objection was taken to that degree of control in order that the various areas might be of mutual assistance to each other. In industrial areas of the nature of that of the East London scheme, however, it was not in the interests of industry that they should be linked up financially with other areas, because such a financial linking-up might tend to increase the price of energy in the one area. At the same time, he recognised the difficulties with which he had to contend in putting forward the scheme, inasmuch as he only had one local authority behind him. The area included in his scheme comprised Islington, Shoreditch, Bethnal Green and Stepney; crossing the Thames it included Beckenham and the supply companies' areas south of the Thames down to Lambeth, Woolwich, Bexley, Dartford, Gravesend, and crossing to the north again the area included the whole of the Romford area of the County of London Co., Ilford, Walthamstow and Stoke Newington. None of the companies in the area had signified any intention of joining the scheme, and nearly all the local authorities, with the exception of Poplar, were members of the Conference of Local Authorities. However, he did not suggest that the Commissioners should do more than indicate that they would be willing to constitute a Joint Authority for this area if the authorities in it were willing for that to be done. He could not do more than that. His whole point was that this area was the industrial area of London, as could be seen from the following figures. The units supplied in the East London area increased by 46 per cent. between 1914 and 1920; in the same period the units supplied in the remainder of the area delimited by the Commissioners increased only by 28 per cent.; the corresponding figures for maximum demand were 39 per cent. and 28 per cent., and whereas in the East London area during the same period the load factor increased by 1.2 per cent., in the remainder of the area there was actually a decrease. Again, the respective total costs were 1.434d. per unit and 1.834d. per unit, whilst the percentage of capital charges to total charges was 17.3 per cent. in the East London area against 22.4 per cent. in the area outside. Perhaps, however, the most striking evidence of the industrial character of the area was that 80 per cent. was for power purposes; only 50 per cent. of the demand in the remainder of the area was for power purposes. It was proposed to erect a capital station at Dagenham, because it was calculated that by 1926 the greater part of 100,000 kW would be required, and it was regarded as best to put this into a capital station at once, rather than extend the existing stations.

Developing his case, Mr. Donald suggested the possibility of grouping local authority undertakings and company undertakings, and that would apply respectively to the East of London and Central and West of London, the local authorities being situated in the East.

The Joint Authority under the scheme is to consist of 22 representatives of the local authority distributors, seven representatives of councils having purchasing rights, three representatives of other local authorities, five representatives of the supply companies in the area, three representatives of large consumers and railway companies, and two representatives of labour, or 42 in all.

During the course of discussion between the Commissioners and Mr. Donald, it came out that the Joint Authority might, in certain circumstances, be a committee under a Joint Authority for the whole area, Mr. Donald being anxious to provide for both contingencies.

Mr. J. H. Bowden, chief engineer to the Poplar Electricity Undertaking, then gave evidence in support of the scheme as outlined.

(To be continued.)

Proposals for an Improved Coinage.—Mr. Harry Allcock, M.I.E.E., M.I.Mech.E., draws our attention to the following proposal which has been put forward with the object of simultaneously securing (*a*) a lower cost of living, (*b*) national and private economy, and (*c*) simplified home and foreign accounts.

The proposal is to increase the token value of the penny by 20 per cent., thus dividing the shilling into 10 pence instead of 12, while leaving the present values of the shilling and the £ sterling unaffected; to employ the existing bronze coins to represent these higher values instead of their present values, and to convert the prices now expressed in "low pence" to their equivalents in "high pence" by deducting one-sixth; *e.g.*, three "low pence" would be exactly equal to 2½ "high pence."

The existing sixpenny and threepenny silver coins would still represent the half and the quarter of the shilling, but they would be exchangeable into 5 and 2½ "high pence" instead of 6 and 3 "low pence" respectively.

The following advantages would be secured:—

Lower Cost of Living.—The prices of many pre-war pennyworths now sold at 1½d. could be reduced by 20 per cent. to one "penny." Under existing circumstances no reduction can be made, due to the impossibility of restoring the original penny price, and the impracticability of charging 1½d. by reason of the scarcity and unpopularity of farthing coins.

Simplified Home and Foreign Accounts.—While still retaining the present method of keeping accounts in £ s. d., the home public would gain many of the advantages of decimal coinage (without employing the decimal point) due to the elimination of much compound arithmetic, *e.g.*, 89 pence would be 8s. 9d. instead of 7s. 5d.

In their foreign accounts British exporters could express all £ s. d. values in £ and decimal parts thereof (because the "penny" would then be a decimal submultiple of the £), thus meeting the convenience of their foreign customers, who all employ and prefer decimal coinage.

At convenience this practice of expressing shillings and pence as a decimal fraction of the £ could be adopted in home trade as well as in foreign trade without any further alteration of coin values. The old problem of completing the decimalisation of the £ would thus be solved in easy stages.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

16,442. "Sparking plugs." H. Lodge. June 15th.
16,473. "Excitation of dynamo-electric machines." R. J. Butler and Metropolitan-Vickers Electrical Co., Ltd. June 15th.
16,484. "Electric lampholders and adapters." L. B. Codd and C. Martin. June 15th.
16,492. "Electric time-alarms." W. Meiser. June 15th.
16,494. "Electric condensers." K. E. J. Varret. June 15th. (France, April 11th.)
16,499. "Microphones." W. K. L. Dickson. June 15th.
16,504. "Air-removing apparatus for mercury-vapour rectifiers, &c." Siemens-Schuckertwerke. June 15th. (Germany, June 15th, 1920.)
16,513. "Burglar, &c., alarm systems." S. G. Adams. June 15th.
16,515. "Electric hooters." F. G. Bell, W. C. Davey and Sterling Telephone and Electric Co., Ltd. June 15th.
16,520. "Electric furnaces." Tungsten Manufacturing Co., Ltd., and E. H. Weston. June 15th.
16,528. "Sparking plugs." G. Lister. June 15th.
16,531. "Electron discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). June 15th.
16,532. "Telephone systems." L. Drouet and A. Thomas. June 15th. (France, June 17th, 1920.)
16,569. "Automatic electric circuit-breakers." A. E. Angold, A. H. Railing and H. C. Turner. June 16th.
16,574. "Electro-magnetic wave transmission systems." Soc. Francaise Radio-Electrique. June 16th. (France, October 16th, 1919.)
16,588. "Electro-magnetic wave-signalling systems." G. Hill and J. O. Mauborgne. June 16th. (United States, June 16th, 1920.)
16,595. "Dynamo-electric machinery for electric welding, &c." B. A. M. Boyce, Brush Electrical Engineering Co., Ltd., and P. Huggins. June 16th.
16,606. "Electric radiators." H. H. Berry. June 16th.
16,619. "Electrolytic decomposition of alkali salts." M. Wilderman. June 16th.
16,624. "Electrical controllers." Metropolitan-Vickers Electrical Co., Ltd. June 16th. (United States, July 15th, 1920.)
16,629. "Electric lighting for motor-cycles, &c." S. L. Price. June 16th.
16,639. "Means for producing alternating electric currents." H. J. Round. June 16th.
16,640. "Electrical transmission." A. M. Taylor. June 17th.
16,716. "Fastening devices." British Thomson-Houston Co., Ltd. (General Electric Co.). June 17th.
16,717. "Alternating-current distribution systems." British Thomson-Houston Co., Ltd., and F. H. Clough. June 17th.
16,718. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). June 17th.
16,724. "Electric water-heater." W. Colebrook. June 17th.
16,731. "Liquid electrical resistance." E. C. R. Marks (Siemens-Schuckertwerke). June 17th.
16,736. "Electric bed-warmer." H. Guggenbuhl. June 17th. (Switzerland, September 7th, 1920.)
16,737. "Protecting-arrangements for electric switches, &c." J. E. Pollak (Naamlooze Vennootschaphengelosche Electrische en Mechanische Apparatenfabriek Heemaf). June 17th.
16,738. "Rotary high-tension electrical machines with oil bath." K. V. Kando. June 17th. (Hungary, June 10th, 1918.)
16,747. "Sparking plugs." P. H. Butler. June 17th.
16,780. "Apparatus for connecting flexible wire cables." A. A. Tunley. June 18th.
16,782. "Electric relays." J. Boot, L. de M. G. Ferreira, and Siemens Bros. & Co., Ltd. June 18th.
16,798. "Vapour lamp for heating." C. E. Clarke. June 18th.
16,799. "Means for indicating period of and/or controlling electrical oscillations." N. W. Simpson and A. M. Young. June 18th.
16,800. "Anodes for mercury vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. June 18th. (Switzerland, June 18th, 1920.)
16,809. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). June 18th.
16,811. "Magnetos." C. Seal and E. Urbain. June 18th. (France, June 18th, 1920.)
16,820. "Sparking plug." J. Darroch. June 20th.
16,833. "Means of generating direct-current voltages." G. Sutton. June 20th.
16,840. "Loud-speaking devices for wireless receiving-sets, telephones, telegraphs, &c." J. W. Greenwood. June 20th.
16,876. "Mercury-vapour pumps for high vacua." Akt.-Ges. Brown, Boveri et Cie. June 20th. (Switzerland, June 24th, 1920.)
16,879. "Signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 20th.
16,882. "Apparatus for sorting fragmentary materials by electric conductivity." H. L. A. Schweitzer. June 20th. (France, June 18th, 1920.)
16,884. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 20th. (United States, November 29th, 1920.)
16,888. "Annular electrical contact for electric wires." Merz-Werke (Geb Merz & A. H. Mollik). June 20th. (Germany, October 11th, 1920.)
16,894. "Electric radiators." J. Y. Fletcher and R. J. H. Hill. June 20th.
16,907. "Automatic telephone exchanges." B. B. Johnson and Relay Automatic Telephone Co., Ltd. June 20th.
16,910. "Electrically-operated tools." H. G. Kessler. June 20th.
16,914. "Adjustable resonant circuits for radio-telegraphic apparatus, &c." A. W. Sharman. June 20th.
16,929. "System of secret wireless communication." E. G. H. Beresford. June 21st.
16,931. "Electrical water-heating apparatus." R. Hacking. June 21st.
16,955. "Means for preventing oxidation and volatilisation of contacting parts in induction coils of internal-combustion engines." F. C. Perrem. June 21st.
16,966. "Electric batteries." Svenska Ackumulator Aktiebolaget Jungner. June 21st. (Sweden, June 21st, 1920.)
16,968. "Electric lamp holders." W. Barnett, B.S.T. Electric Fittings Co., F. Saunders and P. J. Thompson. June 21st.
17,013. "Self-cleaning spark plugs." Champion Ignition Co. June 21st. (United States, July 12th, 1920.)
17,014. "Wire-clamping terminal for low-voltage installations." Scintilla. June 21st. (Switzerland, June 24th, 1920.)
17,024. "Ignition devices for internal-combustion engines." C. Pressland. June 21st.
17,029. "Short-circuit detectors." Am-O-Meter Co. and S. T. Sherrill. June 21st.
17,062. "Supply of electrical current to factories, &c." R. E. Smith. June 22nd.
17,073. "Electrical fire-proof holders for half-watt lamps, &c." H. C. Tudor. June 22nd.
17,104. "Sparking-plug testing device." C. S. J. Bailey. June 22nd.
17,105. "Reception of electric signals." J. Hettinger and C. A. Vandervell & Co., Ltd. June 22nd.
17,106. "Photographic recording of electric signals, &c." J. Hettinger and C. A. Vandervell & Co., Ltd. June 22nd.
17,114. "Determining cross-talk in multi-pair telephone cables, &c." F. Breisig. June 22nd.
17,115. "Pair of self-induction coils for charging duplicable four-line telephone systems according to the Pupin system." Felten & Guilleaume Carlswerk Akt.-Ges. June 22nd. (Germany, June 25th, 1920.)
17,120. "Selectively-operable devices for selective signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). June 22nd.
17,128. "Evacuation of electric lamp bulbs, &c." Patent-Treuhand-Ges. fur Elektrische Gluhlampen. June 22nd. (Germany, June 22nd, 1920.)
17,148. "Switching devices for electric machines." V. Breeze and A. West & Co., Ltd. June 22nd.
17,163. "Prevention of interference in wireless circuits." E. W. Whiston. June 23rd.
17,179. "Electric controlling-devices for prime movers." C. Leffler. June 23rd. (Germany, July 5th, 1920.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

11,088. "Process and apparatus for the separating of suspended bodies from electrical insulating fluids, more particularly gaseous fluids." Moller. July 31st, 1914.

1919.

4,720. "Telephonic systems." E. A. Graham. February 25th, 1919. (164,368.)
19,424. "Printing apparatus suitable for reproducing in ordinary printed characters telegraphic messages." Creed & Co., Ltd., and F. G. Creed. August 6th, 1919. (164,370.)
20,820. "Telegraphic receiving perforators." Eastern Telegraph Co., Ltd., A. Fraser, K. L. Wood and E. C. Smith. August 25th, 1919. (164,373.)
25,553. "Metal electrodes for use in the welding or deposition of metals." E. A. Atkins and Rylands Bros., Ltd. July 19th, 1920. (164,380.)

1920.

342. "Sparking plugs." Soc. Internationale Pour l'Exploitation De La Bougie "Sol." July 31st, 1919. (148,736.)
3,347. "Electric incandescent lamps and the like." A. Woosnam (Naamlooze Vennootschap Metaaldraalampenfabriek "Holland"). February 3rd, 1920. (164,415.)
3,596. "Telephones." R. L. Murray and Telephone Manufacturing Co. (1920), Ltd. February 5th, 1920. (164,421.)
3,722. "Dynamo-electric apparatus for generating and/or delivering alternating current of adjustable frequency, specially applicable for controlling and adjusting the speed of alternating current motors." W. J. Mellersh-Jackson (Neuland Patents, Ltd.). February 6th, 1920. (164,425.)
3,741. "Coil-ignition apparatus for internal-combustion engines." D. A. V. Rist. February 6th, 1920. (164,427.)
4,117. "Manufacture of negative electrodes for electric accumulators." A Pouchain. February 10th, 1920. (164,431.)
4,118. "Negative electrode for electric accumulators." A. Pouchain. February 10th, 1920. (164,432.)
4,119. "Manufacture of negative plates for electric accumulators." A. Pouchain. February 10th, 1920. (164,433.)
4,120. "Negative plate for electric accumulators and the manufacture thereof." A. Pouchain. February 10th, 1920. (164,434.)
5,942. "Safety-controlling gear for electrically-propelled vehicles." R. Garrett & Sons, Ltd., and H. R. Simpson. February 27th, 1920. (164,437.)
6,480. "Interlocking device for electric switches." E. J. Brothers and J. H. Tucker & Co., Ltd. March 3rd, 1920. (164,451.)
6,678. "Method of and means for electric control of tipping gear upon vehicles." P. F. Smith, E. H. Dine and F. R. Stocks. March 4th, 1920. (164,464.)
6,739. "Electric radiator." C. H. Verity. March 5th, 1920. (164,472.)
7,038. "Electric circuit-breakers and the like." J. Hall. March 8th, 1920. (164,490.)
7,160. "Miners' safety and other electric hand lamps." O. Oldham, G. Oldham and J. Oldham. March 9th, 1920. (164,496.)
7,378. "Electrodes for electric welding." Premier Electric Welding Co., Ltd., and J. H. Patterson. March 11th, 1920. (164,507.)
7,452. "Electric signalling apparatus." F. S. C. Wates and J. L. Major. March 12th, 1920. (Addition to 132,818.) (164,510.)
7,801. "Construction of electric resistances." R. A. R. Bolton. March 16th, 1920. (164,526.)
8,114. "Electric candle lamps." C. A. Damey. March 18th, 1920. (164,536.)
8,424. "Electrically-heated soldering-irons." G. F. Joseph and H. N. H. Cobbold. March 22nd, 1920. (164,543.)
8,782. "Electric-ignition apparatus with constant ignition tension and automatically variable moment of ignition." Landis & Gyr Akt.-Ges. March 25th, 1919. (140,793.)
9,352. "Protective devices for electric circuits and apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). March 31st, 1920. (164,559.)
9,681. "Electric switches, sockets and the like." H. J. Cash and G. Gorringe. April 6th, 1920. (164,565.)
10,061. "Telegraph circuits." A. Orling and Orling's Telegraph Instruments Syndicate, Ltd. April 10th, 1920. (164,571.)
11,200. "Signalling apparatus." W. M. Rolph. April 22nd, 1920. (164,582.)
12,006. "Electric lamp holders." W. A. I. Booth. April 30th, 1920. (164,589.)
12,275. "Electric light fittings." W. S. T. Hards. May 4th, 1920. (164,590.)
12,435. "Vacuum cleaner electric cord take-up." B. J. Tamarin. May 5th, 1920. (164,592.)
13,843. "Signalling systems." Position Light Signal Co. July 13th, 1914. (143,556.)
15,010. "Means for cooling electrodes for use in vacuum electric discharge apparatus." Siemens-Schuckertwerke Ges. June 4th, 1918. (144,295.)
19,749. "Insulating electrical resistances." Bleriot, Ltd. November 8th, 1917. (147,746.)
19,855. "Electrical regulating systems." British Thomson-Houston Co., Ltd. July 10th, 1918. (147,810.)
19,865. "Electrically-driven vehicles." British Thomson-Houston Co., Ltd. July 24th, 1914. (147,820.)
20,404. "Electrodes for electric searchlights." Optische Anstalt C. P. Goerz Akt.-Ges. September 19th, 1918. (148,449.)
22,258. "Telephone receivers intended to be inserted into the auditory channel." Siemens & Halske Akt.-Ges. July 24th, 1919. (149,621.)
32,807. "Electric lighting systems for motor vehicles." Daimler Co., Ltd., and A. E. Berriman. November 20th, 1920. (164,670.)
35,195. "Electrical motor starting systems." Metropolitan-Vickers Electrical Co., Ltd. June 3rd, 1920. (164,678.)
36,492. "Electric blasting and like fuses." E. Cudney. December 30th, 1920. (164,681.)

1921.

3,378. "Negative electrode for electric accumulators." A. Pouchain. February 10th, 1920. (Divided application on 164,431.) (164,685.)
4,606. "Arrangement of the insulators of precipitating installations." E. C. R. Marks (Siemens-Schuckertwerke Ges.). February 11th, 1921. (164,686.)
6,657. "Method and apparatus for compounding direct electric current motors." Akt.-Ges. Brown, Boveri et Cie. March 19th, 1920. (160,461.)
11,402. "Means for improving the current-carrying capacity of existing three-phase alternating current cable systems." A. M. Taylor. September 23rd, 1919. (Divided application on 23,324/19 and 29,802/19. Cognate application 11,403/21.) (164,689.)

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